Management Plan for the Stone Bridge, Pole Bridge, and Pond Brook Properties

Prepared for the Town of Newtown, CT Conservation Commission

2/14/2011

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Photos courtesy of Lucien A. Bouffard

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EXECUTIVE SUMMARY

A. INTRODUCTION AND PURPOSE

The Conservation Commission of the Town of Newtown, Connecticut asked the Yale School of Forestry & Environmental Studies to compose a management plan for three properties the town recently purchased to preserve as open space. Known as Pole Bridge, Stone Bridge, and Pond Brook, the properties comprise approximately 120 acres within a larger landscape of town, state, and land-trust owned protected areas in the southwestern part of the state. The Conservation Commission identified five key management objectives for these tracts, including: maintaining forest health and controlling invasive plants; improving wildlife habitat; providing environmental education; creating trails and other recreational opportunities; and addressing white-tailed deer (*Odocoileus virginianus*) and black-legged tick (*Ixodes scapularis*) issues.

In this management plan we have three broad objectives. First, we describe the properties, in terms of land use history and geology. Second, we analyze the biophysical and social characteristics of the properties. Finally, based on the biophysical and social analyses and the Conservation Commission's objectives, we provide recommendations for managing the three properties.

B. PROPERTY ASSESSMENT

Each of the properties has a unique history—natural as well as cultural—that sets the biophysical parameters for its current plant and animal communities (please see Appendix A for maps on political boundaries, topographic features and waterways). Geologic processes left their mark in the shape and slope of the landscape, the direction and dynamics of water flows, the rocks and boulders left behind, and the parent materials out of which the sites' soils were made. In turn, the history of human uses and abuses of the properties imposes constraints and opportunities in terms of the ages and composition of biotic communities. Far from static, the properties' tree stands and plant communities are now undergoing developmental dynamics of their own.

- *The Pond Brook Property* (29.7 acres) is steeply sloped and crisscrossed with stone walls, legacies of old roads, and other human traces, suggesting multiple uses, including: grazing, crop-farming, working mills, and recent forms of recreation. The property is dominated by well-drained, loamy soils, and feeds into a small stream that forms the northern border of the property. The composition and age of stands is varied, from mixed hardwood stands to red and sugar maple stands, reflecting a mosaic of historic land uses.

- *The Stone Bridge Property* (34.4 acres), also referred to as the "Grady" property, has been used historically for charcoal production and more recently for a natural gas pipeline, a transatlantic telegraph cable line, and open space preservation. The property is dominated by oak and birch trees, with some interspersed hemlock, maple, and beech

trees, as well as a wetland system that meanders through the northern and western sides of the property.

- *The Pole Bridge Property* (53.9 acres) is an upland site, characterized by stands of eastern hemlock and mixed hardwoods; an early successional shrubland dominated by Japanese barberry and other invasive species; and a bottom woods wetland system visited by a dense white tailed deer population. Stone walls and remnants of a foundation suggest agricultural and forestry activities.

C. RECOMMENDATIONS

We have taken it as our mission to provide recommendations consistent with the Conservation Commission's five main objectives, as provided to us by the Commission at the beginning of our work (listed above). Based on a semester of field research, consultation with experts and review of the scientific literature, stakeholder interviews, and our training as foresters and natural resource experts, our recommendations represent our best advice on how Newtown can attain its objectives given the biophysical conditions and community interests at each of the properties. We offer some overarching recommendations for the few issues and/or opportunities that are found at all three properties, as well as property-specific recommendations. These recommendations take form in near-, medium- and long-term steps that Newtown could undertake to implement the recommendations. A thorough and complete description and listing of our recommendations can be found in chapter 6 and Appendices G and H. These are our key recommendations:

Overarching (applicable to all properties)

Because tick-borne diseases are a complex issue impacting many stakeholders and stemming from a complex interaction of social and biological factors, we recommend that Newtown address it through a broad range of land use planning, education, and wildlife management techniques.

To help defray the cost of environmental education and recreation at the properties, we recommend that Newtown apply for a Community Grant from Iroquois Gas Pipeline LP, which provides local governments with up to $15K for Environmental Education and Passive Recreation.

Pond Brook

- To curtail trees from recolonizing the meadow, which provides rare habitat for ground-nesting birds, we recommend implementing periodic mowing.

- To provide community access and opportunities to interpret the site's rich cultural, historic and natural resources, we recommend building a footbridge across Pond Brook (with parking along Pond Brook Road); purchasing nearby property encompassing the

railroad grade; and securing access to railroad grade between properties through trail easements, if possible, or purchases if necessary.

- With its five railroad lines, Newtown has an opportunity to develop a rail-trail into a valuable community amenity; we recommend actively pursuing development of a rail-trail on the old New York, New Haven and Hartford Railroad line, which runs through Pond Brook.

Stone Bridge

- Because most of the tree stands will reach a more open canopy structure if left on their own, we recommend selectively girdling trees to provide den habitat and small gaps in the canopy rather than opening up the canopy with select harvests or small clearcuts.

- We recommend developing the Stone Bridge property as an access or entry point to Lower Block of Paugussett State Forest, which currently lacks access but has trails.

Pole Bridge

- We recommend controlling the large patch of Japanese barberry with mowing and herbicide.

- We recommend timber harvest restrictions due to the erodibility of the soil on the access road and the sensitivity of the hemlock stand.

- We recommend using the kiosk for information on the property's unique hemlock stand and the development of a mountain bike trail.

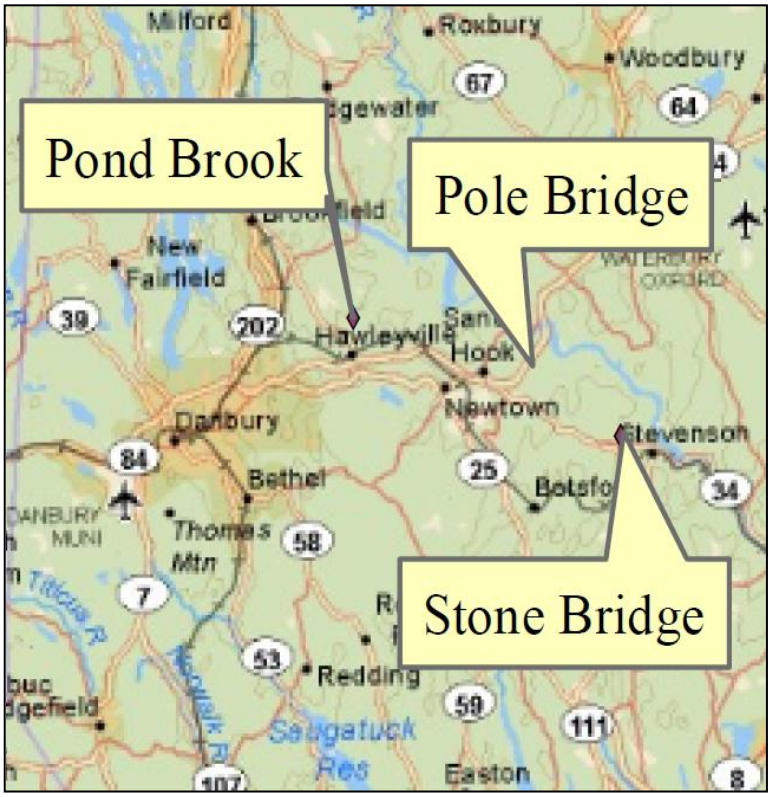
I. INTRODUCTION

A. THE CONSERVATION COMMISSION

The Conservation Commission represents a group of appointed, unsalaried citizens in the Town of Newtown with a broad mandate to conserve natural resources. The Commission works with other commissions and decision makers to research, identify, prioritize, secure, and conserve open space. In the last five years, they spent approximately $12 million to examine and procure special places in the town. Given the current budget and economy, they have shifted from their focus on acquisition to examine more closely what they have and how best to manage it.

B. PROJECT BACKGROUND

The four members of our group are all masters' students at the Yale School of Forestry and Environmental Studies, with different backgrounds, skill sets, and knowledge. One of us is a naturalist from Connecticut; another is a forest manager from Canada; one is a farmer and environmental historian from the mid-west; and another is a conservation biologist and policy-analyst from Texas. Participating in a capstone course, Management Plans for Protected Areas, we worked together and with our client, the Conservation Commission, during the fall 2010 semester to develop a management plan for the Stone Bridge, Pole Bridge, and Pond Brook properties. The context for this work, as previously mentioned, occurs during a time when the town government is looking more closely at its open space properties and how best to manage them, given several objectives and difficult tradeoffs of management options. One regional and salient issue, which especially captures the difficulty of open space management, pertains to controlling Lyme and other tick-borne diseases. While a committee has been assembled to address this matter at the town-scale, we provide several recommendations based on the characteristics of each property.



Our interest in these properties predominantly takes the form of research and study. We are outsiders to policy decisions and the Conservation Commission looks to us for an independent, scientifically informed opinion about management.

C. Outline Of The Management Plan

The content of this plan is organized in several chapters. We begin in Chapter II by providing the geographic context and history of the landscape and the three properties. Based on a deed survey, interviews with long-time residents, and the town historian, this section details the establishment of the town and prominent forms of historical land uses on and near the three open space properties. In Chapter III, we provide the geology, hydrology, and soil profiles of the three properties. This section is based on literary research, field observations, and analyzing soil pits. The following two sections, our assessment of the biophysical (Chapter IV) and social (Chapter V) characteristics, provide the basis for the management recommendations in Chapter VI.

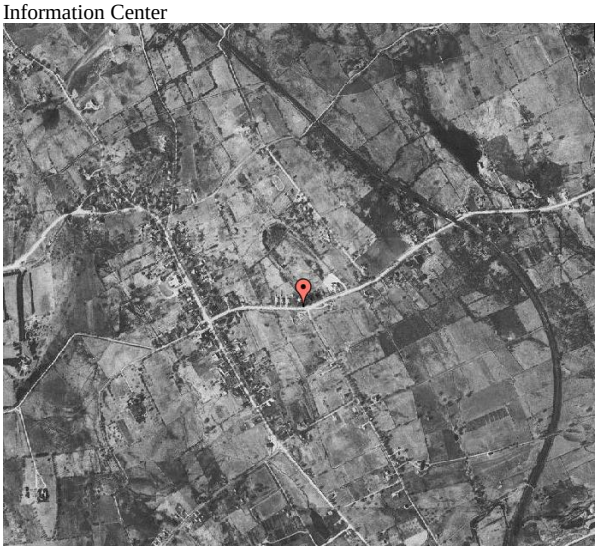
II. GEOGRAPHIC CONTEXT AND HISTORY

A. THE TOWN OF NEWTOWN

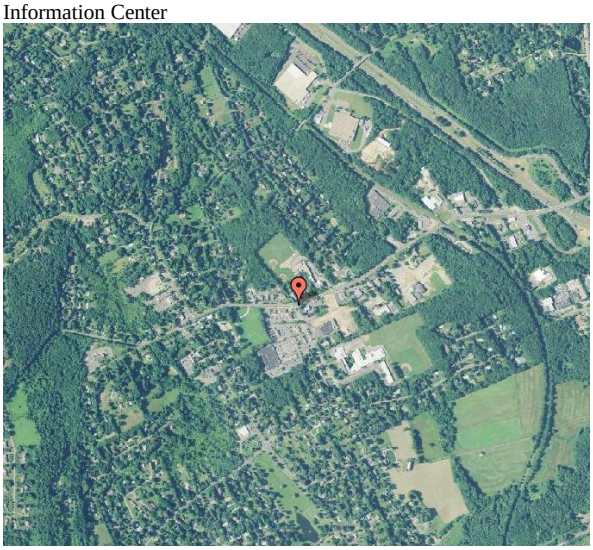
Before the first proprietors moved from the cramped coastal areas of the colony to settle what is today Newtown, Connecticut, the land supported groups of Native peoples that inhabited the Housatonic River Basin for hundreds of years. They spoke a dialect of Easter Algonquian, Quiripi, and crafted pottery from the East River and Windsor Traditions. In the mid-14th century, they were replaced by new inhabitants, though many of the details of this dispersal and initial interactions with early settlers seem to have been lost in the landscape. Today, traces of these peoples are found in the form of quartz knives and fragments of pottery. However, early settlers did not make concerted efforts to record these peoples' stories and many of the Indians were killed by European diseases to which they had no immunity.[1]

Several years prior to the establishment of the town in 1711, the proprietors first settled the area. Bringing their families from Stafford and Milford, they constructed cottages, barns, orchards, and gardens for herbs and vegetables. Beyond their home lots, early settlers each had several acres to raise food crops and cattle fodder to support their families with an agrarian lifestyle. In the following years, some early settlers moved away from Main Street to their distant holdings, where they established small communities like Sandy Hook. Saw and grist mills emerged soon thereafter to support the burgeoning town.

1934 Aerial Photograph of Newtown, CT
Courtesy of University of Connecticut Map and Geographic Information Center



2008 NAIP Map of Newtown, CT
Courtesy of University of Connecticut Map and Geographic Information Center



[1] This section, on the Town of Newtown, is heavily based on information provided by the Newtown Historical Society (see http://www.newtownhistory.org/) and an archival search of the Newtown Bee, available in the C.H. Booth Library.

The Industrial Revolution saw the rise and fall of several industries - small hat shops, button and comb production, resorts and hotels, and rubber manufacturing. Meanwhile, the waters of rivers like the Pootatuck continued to supply power for shops and mills, and the agricultural industry that provided the horn, bone, and hoof for the ailing button and comb industries continued to shape the land. As Dan Cruson, the Newtown historian notes, "The key word is farming." From the orchards and meadow lots of early subsistence farmers, agriculture evolved into intensive dairy farming, fruit-based cultivation, and pasturelands for livestock. While farming had the longest legacy and arguably the most pervasive impact on the land—shaping the horizons of the soil, dividing the land with stonewalls, and impacting the type and composition of trees that colonized abandoned agrarian lands—there are several other historical industries that can be detected. Pits and tailing heaps from feldspar quarries, horse trails (some still in use today), circular formations left by charcoaling, and the railroad tracks leave their marks on the land today.

It was not only Newtown's early farmers, cattlemen, loggers and other individuals who left their marks on the landscape in the form of forests cleared, walls built and soils turned and trod; the land also bears the imprint of the institutions that motivated the individuals and that greatly expanded individuals' ecological reach and impact. These institutions included the growing markets for grain, beef and butter in New Haven, Bridgeport and New York; technology like railroads, iron smelting and the charcoaling needed to feed the smelters; and even policy, such as the Homestead Act and other federal legislation and action that opened the western frontier's more fertile lands and encouraged the westward shift of farming away from Connecticut and the eastern seaboard.

Not only did the regional landscape provide the cattle, trees, and milk to feed the people of New York City, but with urbanization in the 1800s, places like Newtown also offered aesthetic and spiritual sustenance with vacation destinations in the form of resorts and cabins along the Housatonic River (Cruson, 2002).

B. POND BROOK

In 2007, Newtown purchased Pond Brook from Raffie Aryeh to maintain the scenic character of the property and to protect its many habitat features and forest resources from residential development. Historically, the property was a part of an agrarian landscape that supported cattle, crops such as flax, and a few horses, recounts a neighbor whose family has lived along the Brook his whole life. As a child, he recalled finding pieces of bone and button numerous enough to suggest that a button factory was located in the vicinity. His father and neighbors would turn over stone points when plowing the fields. While the area started to become developed gradually in the 1960s, this neighbor recalls that prior to 1960, his family's home was the only all-year residency. All the others held summer homes and left with the first snowfall.

Running along the property's northern boundary, Pond Brook historically provided a hydropower resource and opportunities for fishing and trapping. The property is bordered on the

south and east by stone walls that may have been built by Benjamin Hawley, who bought the property in 1880 from Calvert Smith. Three stone walls running north to south also subdivide the property. Known primarily for cattle raising, Benjamin Hawley sold cattle to markets in New Haven and Bridgeport. He also had an extensive dairy business. The Hawley family is identified with the Hawleyville section of Newtown in which Pond Brook is located, and are probably its namesake (JH Beers, 1899).

Of the five railroads that ran through Newtown, one was the New York, New Haven and Hartford Railroad (indicated on historical maps as the "NY, NH and H RR") that ran along the northern edge of Pond Brook. It was created in 1868 as the Shepaug Valley Railroad.
Evident on maps dating to the 1800s is a dam across Pond Brook with a four to five acre reservoir. A survey map of the property dated 1951 calls the reservoir "Pond Brook Dam." The dam had been washed away by the 1955 flood, long before Raffie Aryeh purchased the property from Thomas Meehan in 1980. The property map prepared for that sale shows the tennis court and other recreational amenities within the floodplain upstream of the dam; some of these are still evident today. Although we could find no direct evidence of who built the dam or when it was built, there are references to a "milk factory" and "Milk Condensing Company" in the property boundary description of the deed when Benjamin Hawley bought the property from Calvert Smith in 1880. During the Civil War, Gail Borden licensed many factories to make condensed milk with his patented vacuum process to meet the Union Army's demand. Perhaps the Milk Condensing Company was located on or next to the property and built the dam so it could have reliable hydropower. The creameries in Hawleyville and Newtown were loading stops for the famous "Big Milk" train that stopped first in Bridgeport before continuing to New York City (website: http://www.kinglyheirs.com/NewYorkStateRailroads/MilkTrain1.html). Still other neighbors and community members point to other potential uses of this and nearby mills, including for processing apples to make cider, a power source for a nearby button factory, and as a gristmill for grounding wheat and corn.

The fact that Newtown was a tourist destination for New Yorkers may explain why numerous owners of Pond Brook in the early 1900s were absentee owners from New York City. One can easily imagine them enjoying swimming in the Pond Brook Dam reservoir and finding respite from the heat and hustle of the city amid the property's hemlock-hardwood grove.
When Herman and Edith DeVries bought parcels A and B from Frank Krawiecki in 1951, they also purchased a 4.79 parcel from the New York, New Haven and Hartford Railroad Co.

C. POLE BRIDGE

Purchased in 2002, the central parcel at Pole Bridge represents the first and most prioritized acquisition under the town's open spaces acquisition program. In addition to connecting two adjoining properties—one to the north, the other to the south—that had previously been set aside by developers, this parcel provides a viewshed, opportunities for hemlock preservation, and avoidance of development (e.g. roads and structures) that might compromise the view shed and degrade the ecosystem.

Collectively, the three parcels that now constitute Pole Bridge share a long history of multiple uses, particularly agriculture dating from the 1800s to the recent past. 19th century stone walls crisscross the property in several locations. Remains of Fairfield County's largest poultry shed can be found in the northeastern part of the property. The deeds recording the sale of Pole Bridge also bespeak its agricultural use. When Sally Curtis sold the property to Cornelia Curtis in 1878, one Charles Beresford was recorded as a witness to the sale. By 1905, Cornelia Curtis had died and Beresford was ready to buy the fifty acres that included the property from her estate.

However, during the late 1920s, as millions of farmers were going bankrupt and losing their land, Beresford sold the property to Florence Symonds, who lived in the Bronx, for $1. Presumably Symonds, as an absentee owner living in New York City, was taking spiritual sustenance from the land while the deed included a provision to allow Beresford to continue to depend on it materially. As is spelled out in the deed, the sale to Symonds was "subject however to the care, support, maintenance of the said grantor [Beresford] in the manner to which he has been accustomed, being, and they all hereby made a charge upon the lands herein conveyed, for and during the term of his natural life said charge to run with the land" (V. 73 page 332, Newtown Land Records).

Even industrial demands for raw materials and the spreading of the country's road and telephone systems touched the property, and are duly recorded in the deeds. In 1900, one owner allowed a prospector to search for minerals and fossils; the lack of mining pits suggests the search proved fruitless. A couple of years earlier, an owner ceded rights to the Southern New England Telephone Company in 1898 to set and maintain four cabled poles on the property, as well as rights to the American Telephone and Telegraph Company (AT&T) in 1899 to construct, operate, and maintain lines over the property. Small pieces of the property were also transferred to the state to build the corridor for Route 6.

D. STONE BRIDGE

The Stone Bridge Property was acquired by the town of Newtown in 2007. It is also known as the "Grady" property because its previous owners were the Gradys, including Kathleen Grady and Ann McGlinty Grady, who received it upon her husband's death. In the early 1960s, Frank McGlinty consolidated properties in the area. The Gradys were the most recent of three families who owned and passed the property between family members, beginning with the Bemis family in the 1850s. Prior to being purchased by McGlinty, the property was held by three women in the Smith family. Samuel W. Smith purchased it in 1915 from Robert Wheeler. When Samuel W. Smith died in 1955, ownership passed to his wife, Mary E. Smith. Upon her death two years later, Pauline Smith and then Sarah Smith owned it until they sold to Frank McGlinty in 1962. Dating at least as far back as the 1850s, William Bemis was the first Bemis to own the property. In the first of an unusual series of transactions, he sold the property to Harriet Tomlinson in 1857 for $1,000. The following year, she sold part of the property back to him for $1. Then, almost fifty years later, Fred and Isabella Bemis bought it from Samantha B. Warner for $1. These nominal prices probably reflect exchanges between members of the Bemis family, or trades between them for other lands.

With its many rocky outcroppings and significant acreage in wetlands, Stone Bridge likely was not tilled. Nor does it have stonewalls that so frequently bear evidence of grazing in the 1800s, or earlier. Instead, its trees and soils bear the record of charcoaling, a form of energy extraction that converted forests into an industrial energy feedstock that was more dense and easier to handle than wood. The 1880s and 1890s were the height of charcoaling; by the 1920s, the charcoaling industry around Newtown had smoldered out. In the case of Stone Bridge, the charcoal market was the steam engines in Bridgeport. Making charcoal involved piling wood in circles about fifteen to twenty feet wide, covering them with soil and turf and then burning the wood continuously.

Newtown historian Dan Cruson believes that the Stonebridge forests were cut to fuel a brass manufacturer in Waterbury. Although we found no direct evidence of who owned the forests when they were cut for charcoal, it is possible that the deed transfers offer a clue. In contrast to its family ownership by the Gradys, Smiths and Bemis families, Stone Bridge had one owner who bought and sold the land in a fairly short time period, and who had no other family ownership. Robert Wheeler bought the property from Fred Bemis in 1906, during the charcoaling period, and then sold it to Samuel Smith in 1915.

Clearer indications of Stone Bridge's use persist to this day. Many of the trees at Stone Bridge have forked or divided stems, a common sign of coppicing, the practice of cutting trees from re-sprouted stumps. Charcoal crews probably cut over forest tracts numerous times, letting stumps re-sprout. In addition, in a soil pit we dug at Stonebridge, we found a layer of ash; the soil pit was located next to a circular depression that could have been a charcoal pit. This history also establishes an age range for the oldest trees at Stone Bridge.

Stone Bridge is adjacent to the southern block of Paugussett State Forest, which was purchased by the state in the 1930s when the land was inexpensive.

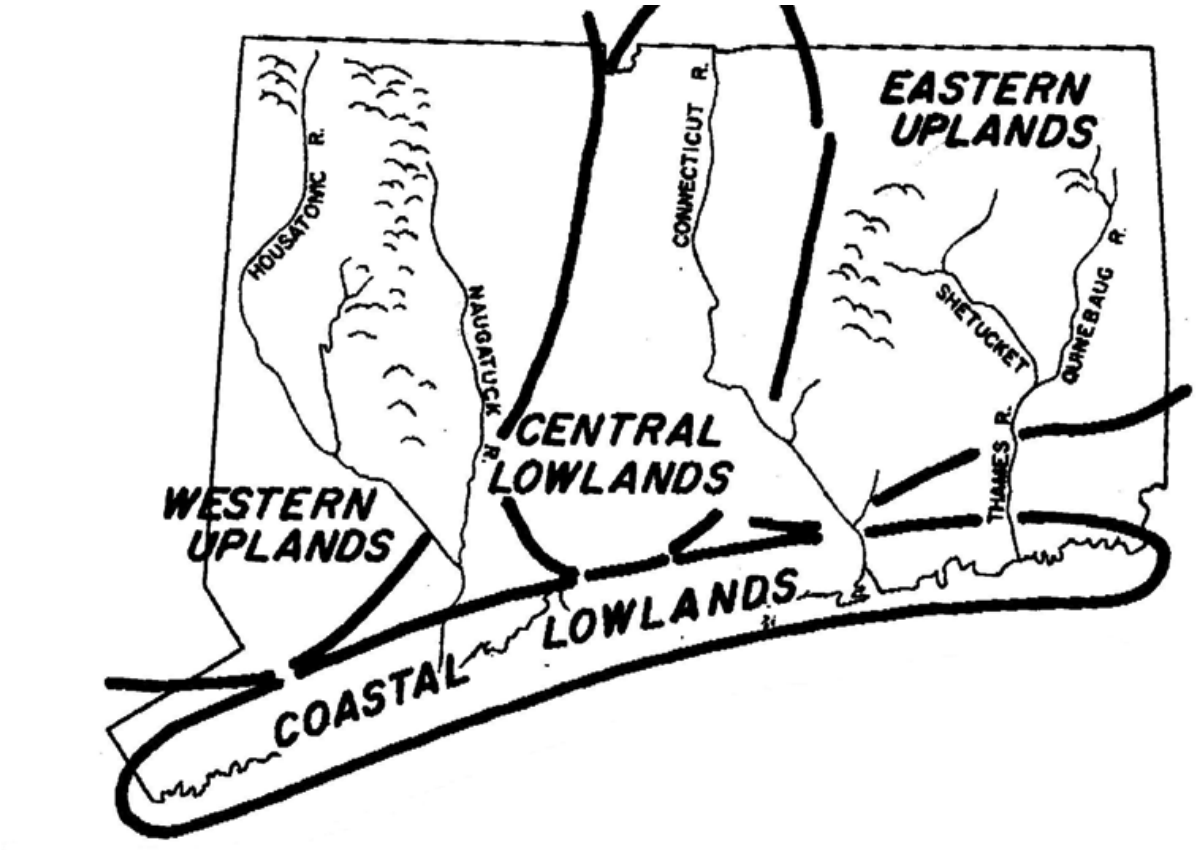
References:
Cruson, D. 2002. Newtown, 1900-1960. Arcadia Publishing, SC.

III. GEOLOGY, SOILS, AND HYDROLOGY

A. INTRODUCTION

Newtown lies in the Western Upland, one of Connecticut's three physiographic regions (excluding the coastal lowlands included in Figure 1). The Western Upland is underlain by gneiss and schist bedrock dating to the Paleozoic. Approximately 12,000 years ago, advancing and retreating glaciers deposited unsorted till soils and drumlins. Melting glaciers also sorted outwash soils down slopes, depositing cobbles, gravel and coarse sands at higher elevations and on steeper slopes while depositing finer sands and silts at lower elevations, where slopes decrease and eventually level off.

Figure 1: The Physiographic regions of Connecticut. Originally from Connecticut Interregional Planning Program, Physical Geography, 1963. Copied from CT Department of Environmental Protection website: http://www.ct.gov/dep/lib/dep/outdoor_recreation/scorp/SCORP_Chapter2.pdf



These depositional patterns are evident in the arrangement of soils at Stone Bridge, Pole Bridge and Pond Brook. A typical pattern is evident at Pole Bridge. Stony Hollis-Chatfield soils were deposited on the 15-25% slopes at the top of the north-facing hill; Charlton soils were deposited farther down, on the 3-15% slopes; fine sandy Sutton soils accumulated in concave positions or

in depressions; and finally Scarboro muck was deposited where the slope flattens near the northern edge of the property, along the Interstate 84 corridor. Sedimentation after glacial melting added to these depositional gradients (Soil Conservation Service, 1981).

Like much of the Western Uplands, Newtown's lands are rolling to steeply sloping, with water drainage in narrow valleys. Around Newtown, streams run to the Housatonic River in the east, which then flows to Long Island Sound. Though the regional aspect is eastern and southern, local hydrology is more varied, depending on site-specific topography. Much of both Pole Bridge and Pond Brook, for instance, have significant northern aspect, and so much of the water flows north through these sites before nearby streams head east.

How water flows through the sites depends on slope and soil type. Water flows through well drained to excessively drained mesic soils, which are found on gentle to steep slopes. At Stone Bridge, Pole Bridge, and Pond Brook, hydric soils are usually found in the bottoms of valleys, but are occasionally found at Pole Bridge in concavities on slopes. We found no xeric soils at the sites.

B. DESCRIPTION OF PARCELS

Stone Bridge

Stone Bridge is situated approximately two miles west of the Housatonic River, and straddles the western edge of its valley. Its soils were sorted by glaciers and subsequent erosion, with stony, coarser Canton-Charlton on the hilltops and steepest slopes, Woodbridge fine sandy loam and/or Paxton and Montauk where the slopes decrease, and then finely-textured muck of the Catden and Freetown soils where there are flat, low-lying depressions (Soil Conservation Service, 1981). Only the eastern side of the parcel has an eastern aspect and thus drains directly toward the Housatonic. However, few if any flows or streams are evident on the eastern side of the parcel. Water seems to flow through the sandy soils rather than across the surface.

In contrast, the western half of the property has two significant drainage systems. One flows into a significant wetland on the northern edge of the property. Numerous ephemeral streams flow into this drainage from the westernmost side of the property. The other system flows into a smaller wetland along the south side of the property. Eventually, these wetlands feed streams draining to the east and the Housatonic.

Pole Bridge

Pole Bridge also is situated within two miles of the Housatonic. Its soils are glacial till or glacial outwash, sorted along elevation gradient, as noted at the outset. Pole Bridge's aspect is predominantly northern, except for the parcel that is located on the south side of the natural gas pipeline, which drains to the southwest. Drainage for the entire site is via a stream that starts

downstream of the southern parcel and then turns to the northeast, running downslope of the site and running down the Interstate 84 corridor to the Housatonic.

The north-facing slope along the property's northern edge is well drained to extremely well-drained, with Hollis-Chatfield, Woodbridge and Canton-Charlton soils. In concavities on these slopes, soils are moist, providing more mesic conditions. Hay-scented ferns may be associated with the more mesic conditions in the concavities. Below these soils, the Haven and Enfield and Sutton fine sandy loam are also well-drained, mesic soils. At the bottom of the hill, along the Interstate 84, water does accumulate in the hydric Scarboro muck soils (Soil Conservation Service, 1981).

There is a significant wetland in the southern parcel. The soils might be Scarboro muck, which is not indicated on the Fairfield County soil map.

Pond Brook

Pond Brook is located four to five miles west of the Housatonic. Its soils are glacial tills and outwash, sorted along elevation gradients. The site is moderately to steeply sloped to the north and west. The depositional soil sequence begins on the higher reaches of the property, along its southern edge, where the cobbles and coarser soils were deposited. One glacial erratic was deposited upslope in the central part of the property.

All drainage flows to the scenic Pond Brook, which forms the western and northern border of the property. Beginning close to the southern edge of the property, an ephemeral stream drains straight to the north. Along the slope on the eastern edge of the property, water seems to seep under the Hollis-Chatfield and Canton and Charlton soils; numerous ferns are associated with these more mesic conditions. Although no sizable hydric sites are located on the property, there is a large area of Scarboro muck soil just outside the western side of the property (Soil Conservation Service, 1981).

References

CT Department of Environmental Protection. 2006. CT Statewide Comprehensive Recreation Plan, http://www.ct.gov/dep/lib/dep/outdoor_recreation/scorp/SCORP_Chapter2.pdf

United States Department of Agriculture, Soil Conservation Service. 1981. Soil Survey of Fairfield County, Connecticut. Washington: GPO.

IV. VEGETATION AND HABITAT

A. STAND DELINEATION AND MAPS

In our efforts to provide recommendations to the town for managing their parcels in a manner consistent with the objectives previously described, we developed a sampling design that would impart our effort to inventory and analyze a number of biophysical components on these parcels.[2]

The biophysical units of these three properties were delineated primarily by observational data collection on the ground and are based on four major criteria:

1. Species Composition
2. Density
3. Soils and Underlying Geology
4. Age Class

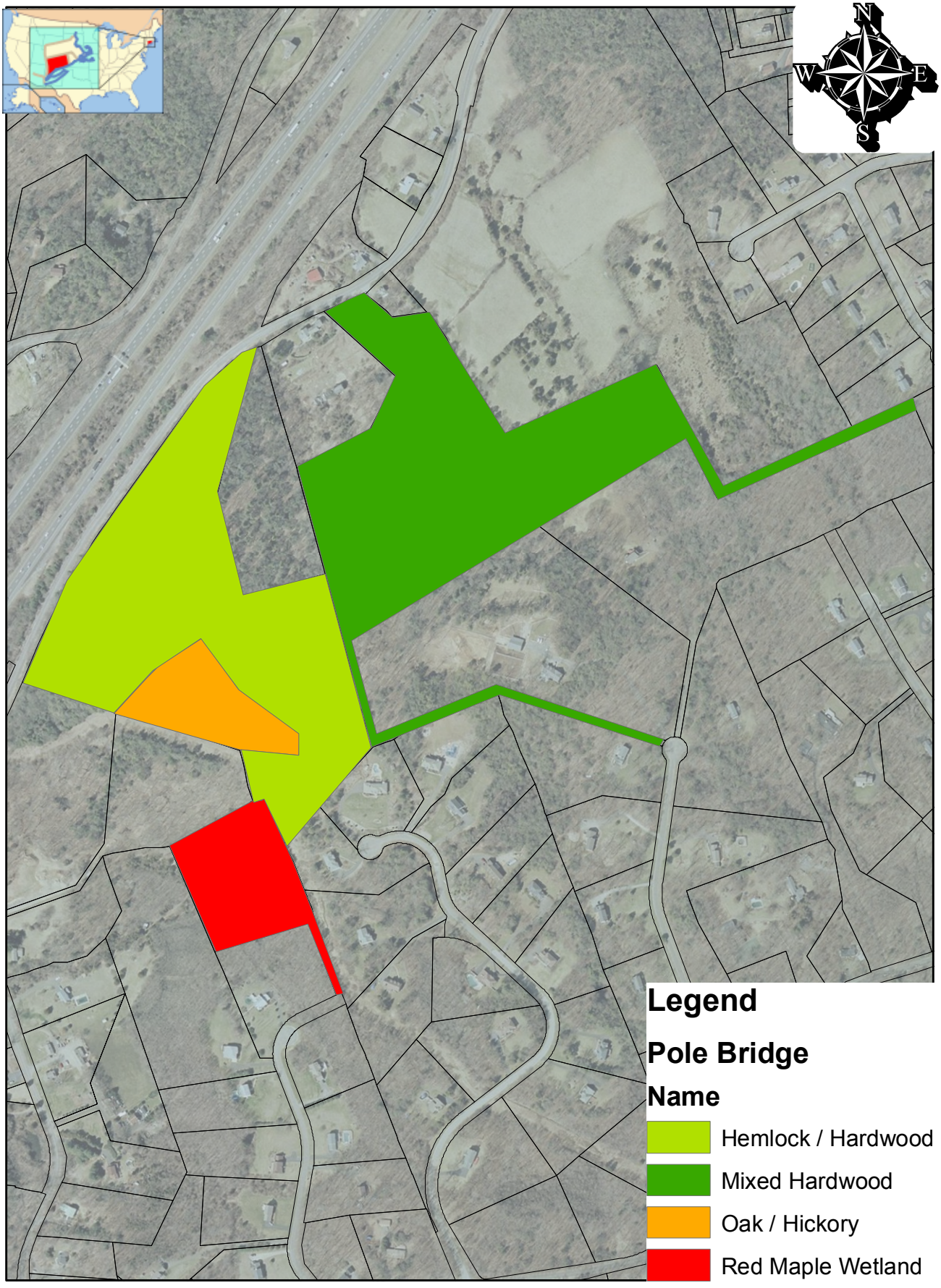
Eight forested stands were identified as well as three non-forested units, for a total of 11 biophysical units.

Pole Bridge Stand	Acres	Pond Brook Stand	Acres	Stone Bridge Stand	Acres
Hemlock-Hardwood	21.5	Hardwood-Hemlock	5.8	Oak-Hickory	33.2
Mixed Hardwood	23.5	Red Maple-Sugar Maple	10.9	Maintained Gas Pipeline Easement	1.2
Oak	3.6	Sugar Maple	11.5		
Red Maple Wetland	4.9	Open Meadow	1.6		
Maintained Gas Pipeline Easement	0.35				
Pole Bridge Total	**53.9**	**Pond Brook Total**	**29.7**	**Stone Bridge Total**	**34.4**

Table 1: Stand Names and Acreages at all three properties

[2] For definitions of technical terms see http://www.dictionaryofforestry.org/.

Pole Bridge Stands



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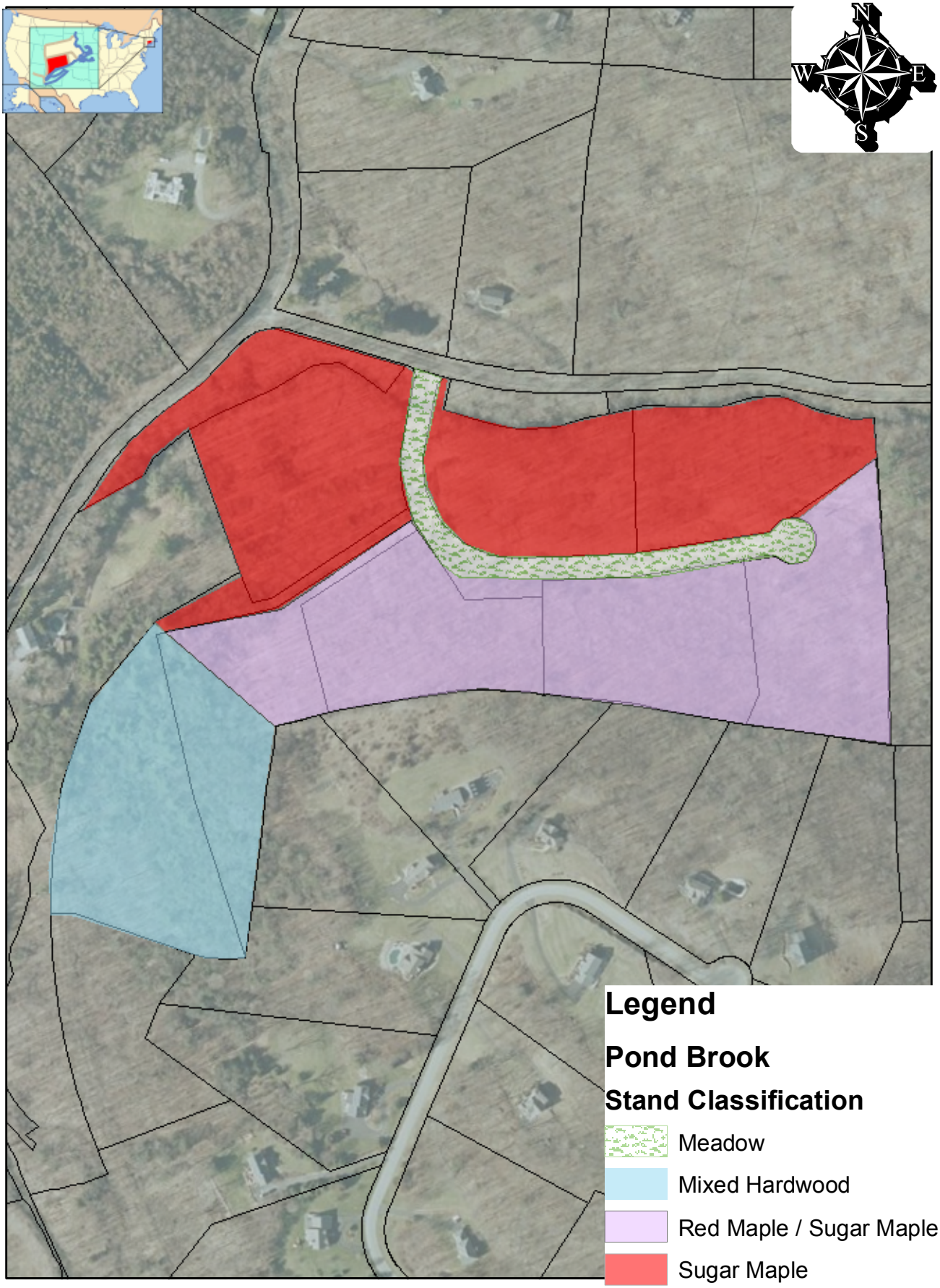
Map Creator: Lucien A. Bouffard

Pond Brook Stands



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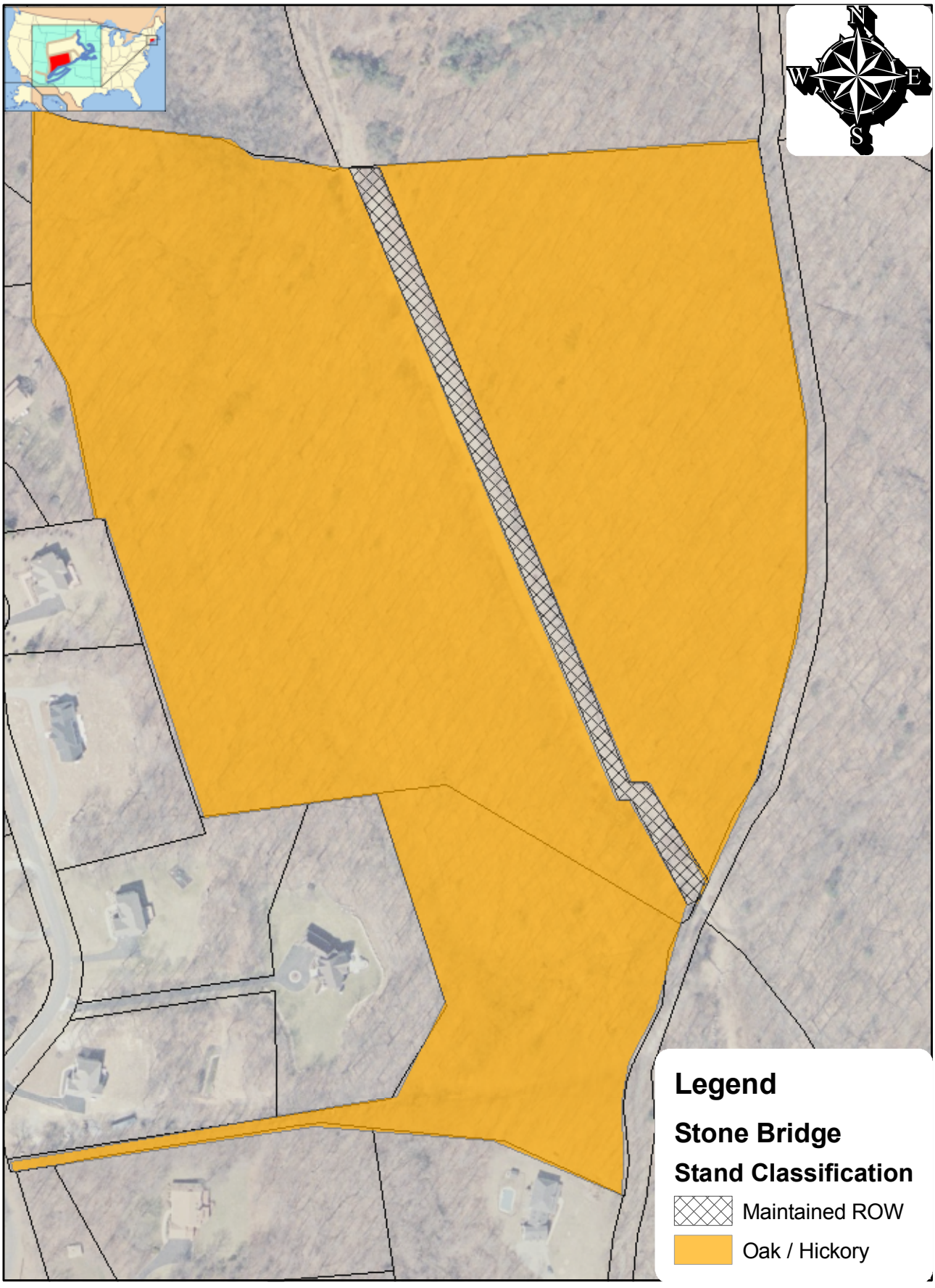
Map Creator: Lucien A. Bouffard

Stone Bridge Stands



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Map Creator: Lucien A. Bouffard

B. FOREST STANDS OVERSTORY RESULTS AND INTERPRETATION

Forest Stands Overview

Based on the results of the sampling methodology applied, this section describes and interprets the past, present and future conditions of the eight forested stands and identifies specific concerns when warranted.

Like the majority of New England, Newtown's forests are second growth, regenerating naturally after land was abandoned from about 1850 onwards. Much land in the area was cleared for agriculture and charcoal production. As crop agriculture and animal husbandry activity came to a close, pioneer species such as eastern red cedar (*Juniperus viriginiana*), black birch (*Betula lenta*) and red maple (*Acer rubrum*) colonized unmanaged fields. Over time, oaks and hickories overtopped the early successional species and usurped the canopy. Most forests are currently in a transition phase towards a more shade tolerant mixture of individuals in the canopy that include sugar maple, American beech and eastern hemlock. Currently, these late-successional species dominate the understory and subcanopy and are becoming an increasingly important part of the forest canopy.

Trees per acre (TPA) and basal area[3] in sq ft/acre (BA) were calculated to compare relative stocking densities across stands. Taken together, these results paint a picture of overstory forest cover. Because of the dichotomy that exists between the number of trees (measured in TPA) and tree size (measured in BA), it is important to compare both results to appreciate the stand overstory as an entity.[4]

Stand Totals		
Stand	Basal Area (sq ft/acre)	Trees Per Acre
Pole Bridge Hemlock-Hardwood	246	419
Pole Bridge Mixed Hardwood	80	202
Pole Bridge Oak	158	1028
Pole Bridge Red Maple	123	1140
Pond Brook Hardwood-Hemlock	155	747
Pond Brook Red Maple-Sugar Maple	115	523
Pond Brook Sugar Maple	128	432
Stone Bridge Oak-Hickory	130	200

Table 2: Stand Trees Per Acre and Basal Areas Totals

[3] The cross-sectional area of a tree measured at 4.5 feet above the ground; a measure of the volume of overstory vegetation in a forested stand.

[4] Please note: An inherent bias when using an angle gauge is to misrepresent small diameter trees, so only the data from trees ≥ 5 inches in diameter at breast height (dbh) were used in all overstory results.

These stand totals illustrate a trend that hemlock presence adds to total overstory biomass productivity and density. Hemlocks rarely limit hardwood[5] overstory productivity because of the differences in tree architecture and shade tolerance- hemlocks grow in a conical shape such that their crowns are located beneath the crowns of hardwoods in the overstory and therefore do not compete with hardwoods with sunlight. Hemlocks grow well in this subordinate position because of their ability to tolerate shade. For this reason, hemlock presence alongside hardwoods in a stand is additive in nature- a stand with both hardwoods and hemlocks can maintain a larger basal area than a stand with only hardwoods (Kelty 1989). In contrast to the overstory, hemlock colonization and establishment into a hardwood stand signifies a transition to a darker groundstory environment, changing the future trajectory of the stand as hemlock trees limit vegetation growth beneath their canopy. Many more conclusions about the present conditions and also interpretations of the future stand conditions can be derived by looking at stands on an individual basis.

Pole Bridge Forest Stands

Hemlock-Hardwood Stand

The second largest and most charismatic stand on this parcel, located in the western half of the property, is a hemlock-hardwood cover type. Most of this stand is characterized by a steep northwestern aspect and is easily distinguished by the large eastern hemlock component, both in the overstory and understory.

Past: The prevalence of hemlock in this stand indicates past land use as a woodlot whereby hardwood trees were selectively cut for firewood, leaving hemlock behind because of its poor firewood quality. After these woodlots were abandoned and left to regenerate, hemlock increased its prevalence and is likely now a larger component of the stand than it was historically. Once chronic firewood harvesting came to an end, hardwoods re-established as a main component in the canopy. The white ash presence in the canopy indicates that the site must have been cut heavily as white ash is an early-successional shade intolerant species that can only establish in full sunlight. Given white ash's shade intolerance, these white ash individuals are representatives of the stand's origin when the woodlot was abandoned and allowed to regenerate.

[5]Hardwood: Broad-leaved tree such as oaks, maples, ashes, etc. Softwood: Coniferous trees like pines, firs, and hemlocks

Present: Today, alongside eastern hemlock, the major hardwood representatives in the canopy are oak species- red (*Quercus rubra*), black (*Quercus velutina*), and white (*Quercus alba*); black birch mainly in the smaller diameter classes, including less than 5 inch dbh (diameter at breast height); white ash (*Fraxinus americana*) exclusively as a canopy dominant, along with a few other minor species like pignut hickory (*Carya glabra*); and sugar maple (*Acer saccharum*).

The high degree of height stratification in this stand also explains the paucity of light reaching the groundstory. We see partitioning of species into various strata based on shade tolerance. The more shade-intolerant species like white ash, black birch and oak species are almost exclusively found in the top stratum of the canopy. However, black birch is also represented in the subcanopy, but these individuals will begin to senesce because of the light limiting conditions. Eastern hemlock is represented throughout all strata, but is the main species found in the understory and midstory since it can tolerate low light levels and grows at a slower rate than its associates.

Pole Bridge Hemlock-Hardwood	
Species	Basal Area (sq ft/acre)
HM	82.5
BB	65
BO	30
WA	30
RM	10
SM	7.5
PH	7.5
WO	5.8
RO	5
XX	2.5

Table 3: Stand Level Basal Area Per Acre By Species. Please consult Table 4 for the species associated with each code. Please note XX= hardwood snag, YY= softwood snag and OTHER= the aggregated basal area for all other species in the stand.

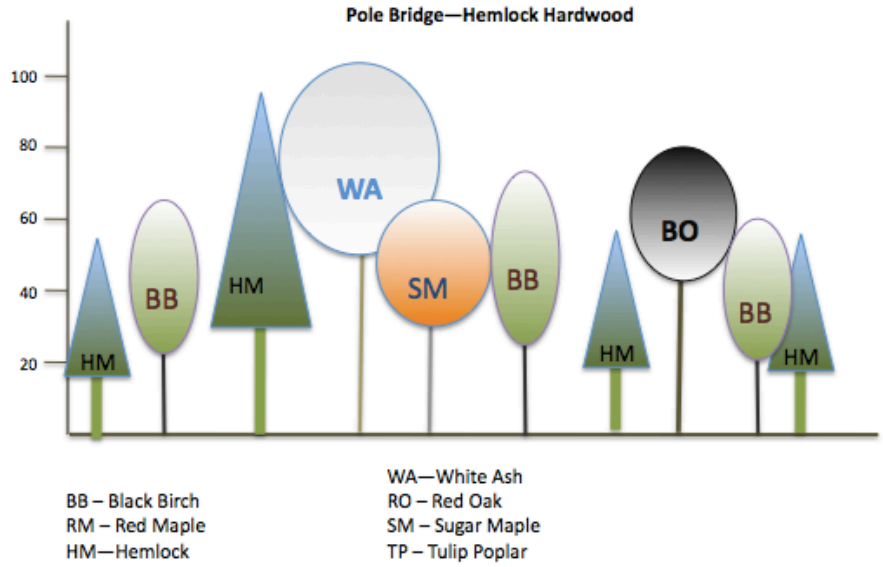

Figure 1: Schematic of Present Day Stand Structure and Species Composition

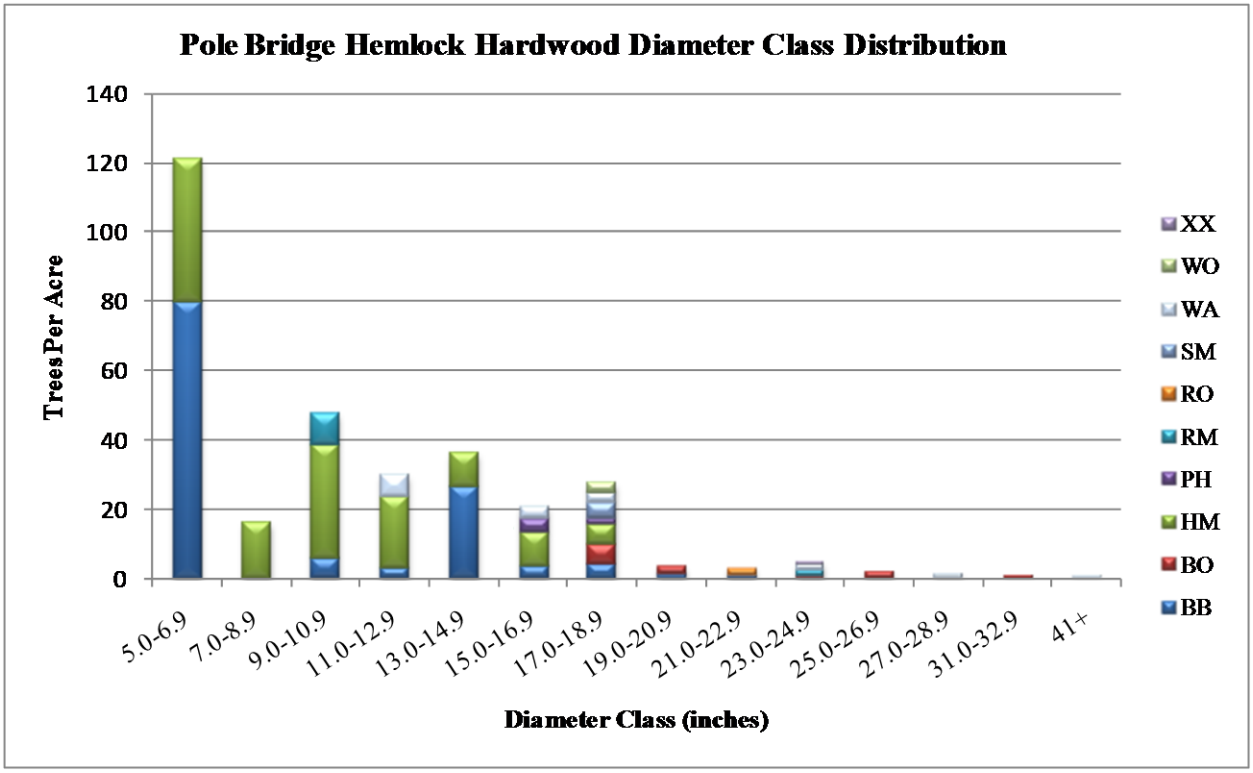

Figure 2: Stand level diameter class distribution by species. Please consult Table 4 for the species associated with each code. Please note XX= hardwood snag and YY= softwood snag.

Common Name	Code	Common Name	Code
Basswood	BA	Pin Oak	PO
American beech	AB	Red Maple	RM
Black birch	BB	Red Oak	RO
Black cherry	BC	Sassafras	SA
Black oak	BO	Shagbark hickory	SH
Chestnut oak	CO	Hardwood snag	XX
Cottonwood	CW	Sugar maple	SM
Eastern red cedar	EC	American sycamore	AS
eastern hemlock	HM	Tulip poplar	TP
Big-toothed aspen	LA	White ash	WA
Musclewood	MW	White oak	WO
Slippery elm	SE	Yellow birch	YB
Pignut hickory	PH	Softwood snag	YY

Table 4: Overstory Species List

Future: Eastern hemlock will continue to perpetuate itself and exclude most other species at the forest floor due to the heavy shade it casts on the forest floor, inhibiting germination and establishment of many species. However, the future of this stand will depend very much on the ability of the eastern hemlock individuals to resist two invasive insects, elongate hemlock scale (*Fiorinia externa*) and the wooly adelgid (*Adelges tsugae*). Hemlock scale is currently present in the stand and will likely become a larger issue in the next 10 years if it continues to thrive. This is mentioned in more detail in the forest health section. However, the hemlocks in this stand have a better chance of fighting off pathogens than many other stands due to its northwesterly aspect, which receives less direct sunlight than most other aspects, buffering against droughty conditions that the hemlock has low tolerance for. For this reason, this stand is of high preservation value. The location of this stand on a northwest facing

slope also shelters it from large windstorms and hurricanes coming from the east, meaning this stand could persist as is for many years to come. The shade-intolerant white ash individuals are long-lived but will not be able to regenerate beneath the hemlock canopy; therefore, once these large individuals die, the white ash component will be lost from the stand unless a disturbance creates a large opening in the canopy.

If a large amount of hemlock is lost due to an insect outbreak and/or prolonged droughty conditions, the stand will open up to allow a much greater degree of light hitting the forest floor. If this occurs, the stand will likely transition to a mixed hardwood cover type with a few hemlock relicts that can persist. Because of the northwesterly aspect, the future canopy would likely be dominated by a combination of mesic species like sugar maple and shagbark hickory. Drier site species like oaks will persist because of seed availability within the stand.

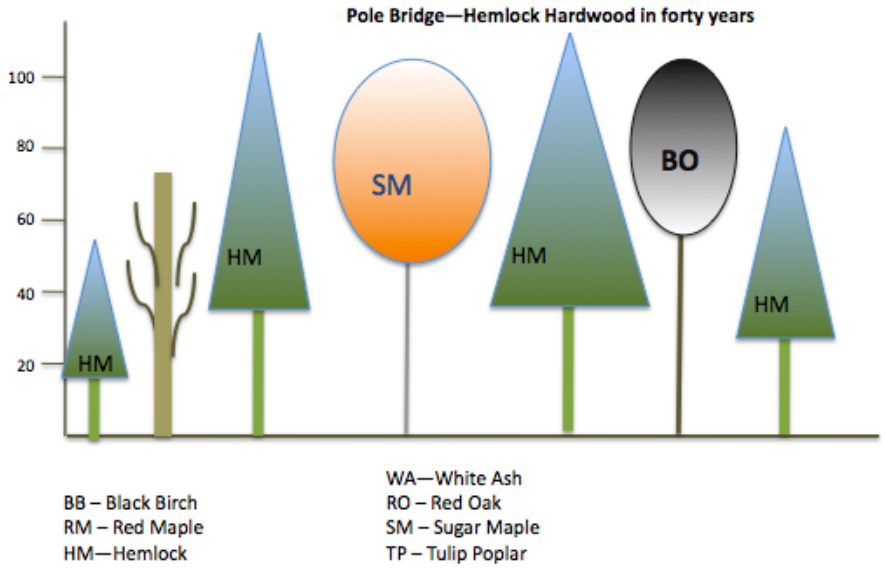

Figure 3: Schematic of Projected Stand Structure and Species Composition in Forty Years

Mixed Hardwood Stand

Past: The presence of eastern red cedar indicates this stand originated from an old field that was most likely pasture land. A plow layer was found in part of this stand and there is a substantial amount of Japanese barberry (*Berberis thunbergii*) in the understory indicating there was a home site nearby where a small amount of land was used for crop agriculture. The proliferation of barberry in the understory suggests this stand was abandoned fairly recently, likely after the 1930s, since Japanese barberry was not planted in home gardens before this time. After abandonment, early successional colonizers of disturbed sites like black birch, white ash and red maple established.

Present: Like many on these town parcels and across southern New England, this stand is in the late stem exclusion phase of forest development. During this stage, competition for light drives stratification of species. For this reason, over the history of this stand mid-successional species like white oak and pignut hickory have grown through and overtopped the previous canopy to take over as the current canopy dominants.

Pole Bridge Mixed Hardwood	
Species	Basal Area (sq ft/acre)
BB	20
SM	15
PH	10
WO	7.5
WA	7.5
OTHER	20

Table 5: Stand Level Basal Area Per Acre By Species

A feature in the central portion of this stand is a pocket of early stem exclusion white ash poles[6]. Most of these ash poles have seeded in from a wolf tree[7] we located at the corner of a stone wall. This feature indicates more recent abandonment of the previous land use, likely horse pasture.

Sugar maple, red maple and musclewood (*Carpinus caroliniana*) are representatives of the understory pole-size class. Sugar maple currently dominates the subcanopy alongside red maple, black birch, and some hemlock individuals. Sugar maple is a shade-tolerant long lived species that can persist and continue to grow in the understory.

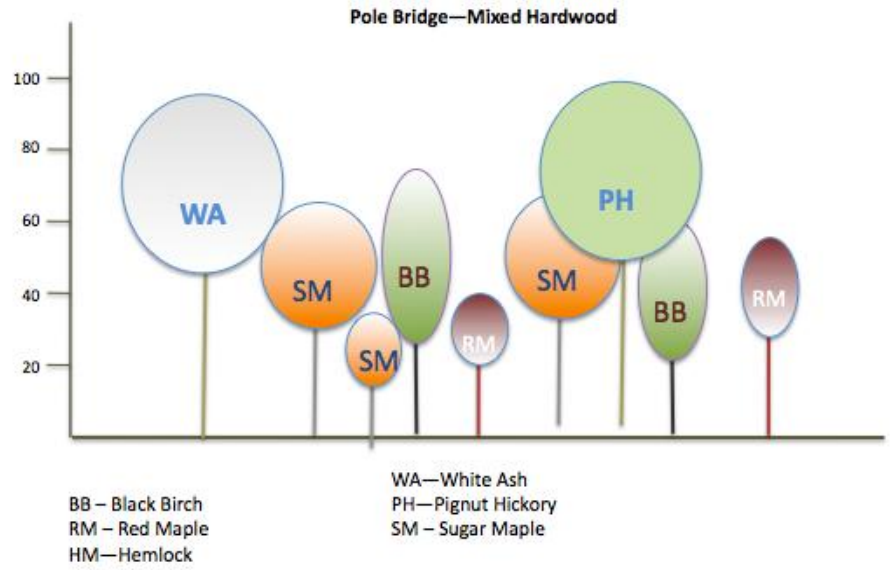

Figure 4: Schematic of Present Day Stand Structure and Species Composition

[6] A pole is defined as a tree at least 4.5 feet in height with a diameter at breast height less than 5 inches
[7] A large live tree with living lower branches as a result of being open grown, likely a remnant of a previous stand that was cleared.

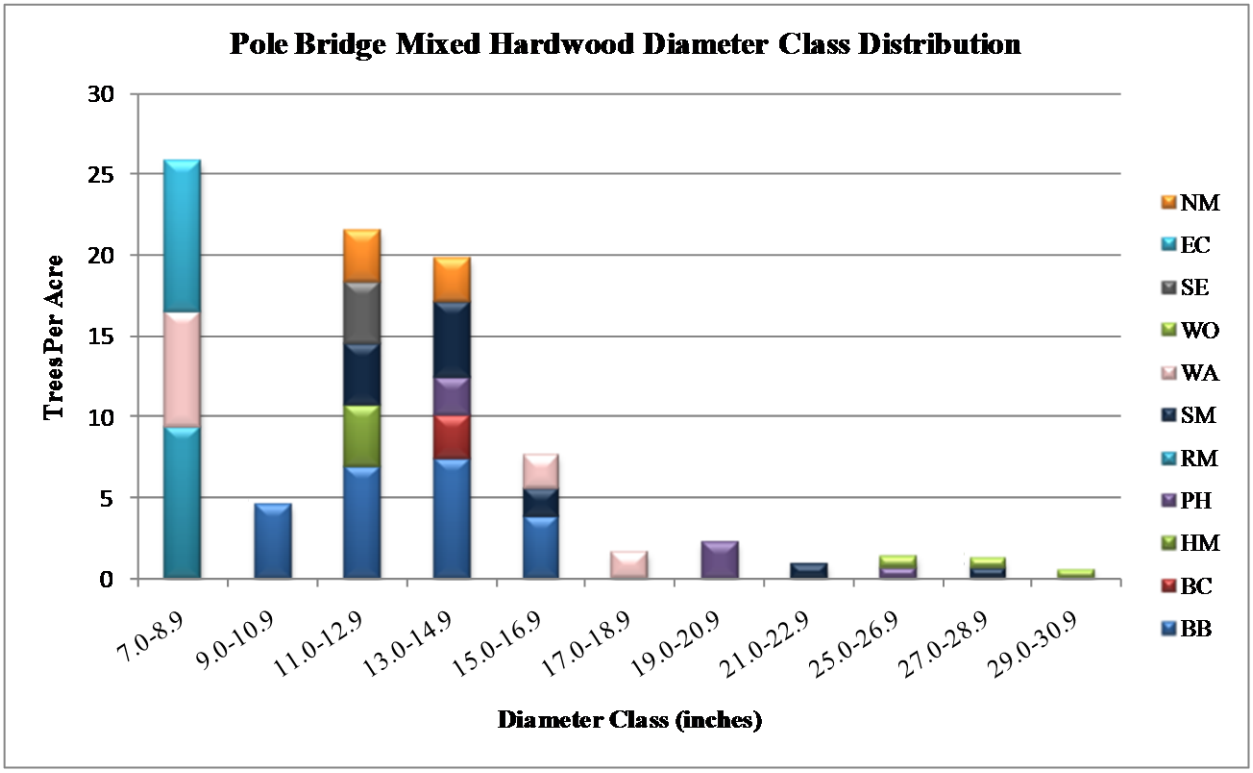

Figure 5: Stand level diameter class distribution by species

Future: The invading black birch and red maple individuals in the subcanopy will die out of the stand in the near future and the subcanopy sugar maple will eventually move into a dominant canopy position, replacing the current canopy. Once a sugar maple canopy has established, without a disturbance, this stand will persist as a shade tolerant mixture of sugar maple along with other shade tolerant species like hemlock. The deep crown of shade tolerant species prevents less shade-tolerant species from establishing since little light reaches the forest floor. An ice storm or high wind event could open up pockets in the future where light seeded pioneer species like black birch will establish and grow up through a gap, likely as a cluster of small diameter individuals.

Oak Stand

A vigorous oak cover type is located upslope from the hemlock-hardwood stand and is fairly flat. This stand borders the Iroquois Gas Transmission Systems, LP easement.

Past: Dead eastern red cedar logs, the presence of stone walls and the variable micro topography indicate this stand was an old field prior to being abandoned and left to return to forest. As with the mixed hardwood stand, black and red maple were the dominant canopy trees of the past and cannot reclaim that position until a disturbance creates a large gap for these species to grow into the canopy.

Present: Black oak is the most dominant canopy species, with its normal associates also represented, including black birch, red maple, other oaks and hickory species. Since this stand is bordered on many sides by the large Hemlock-Hardwood stand, there is a fair amount of eastern hemlock that has seeded in and established in the understory. In more open areas of the understory, there are pole sized red maples and black birch, however, much of this black birch component has low vigor.

Pole Bridge Oak	
Species	Basal Area (sq ft/acre)
BO	72.5
BB	35
WO	17.5
HM	17.5
RO	7.5
RM	7.5

Table 6: Stand Level Basal Area Per Acre By Species

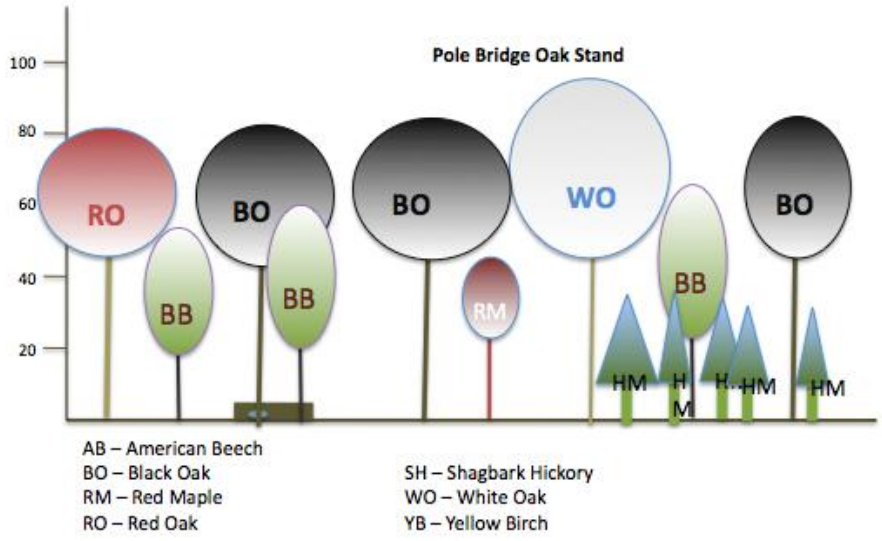

Figure 6: Schematic of Present Day Stand Structure and Species Composition

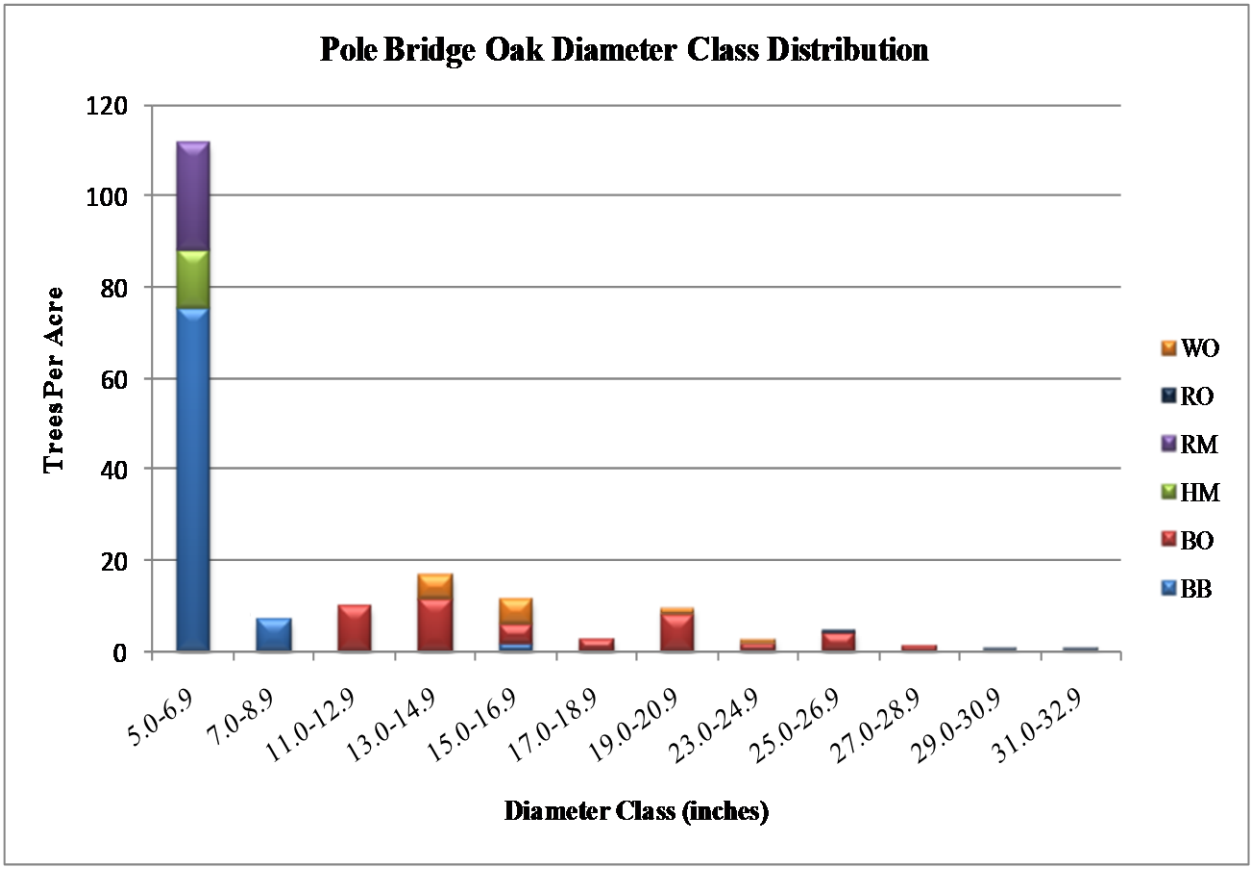

Figure 7: Stand level diameter class distribution by species

Future: There are a fair number of large trees in this stand and when these trees die and fall in the future they will open a gap in the canopy larger than what the adjacent overstory trees will be able to fill. Consequently, there will be direct sunlight hitting the forest floor creating a microenvironment sufficient to germinate seeds of species of multiple shade tolerance classes (tree and understory plant), including black birch, oaks, hickories and maples. However, in areas of dense hemlock understory, it will be difficult for any of the overstory species to regenerate in the next several years and possibly decades.
If advanced regeneration (individuals of relatively shade tolerant species that can persist for many years in the understory) exists beneath the canopy openings created, these individuals will have a competitive height advantage over individuals that are seeding into the area. Furthermore, many hardwood species have an ability to sprout from their root collar when stressed or from the stump of a severed stem, enabling new shoots to grow rapidly by utilizing the large intact root system of the fallen parent individual. This method of reproduction improves a species chance of re-capturing the growing space that was relinquished when the tree fell or as a tree is dying.

Without a large disturbance, this stand will likely transition to a more uneven-aged structure, with a new cohort of individuals growing beneath the current canopy waiting for individuals in the canopy to senesce and open up space in the canopy. The species composition may transition to include a hemlock component in the canopy or it may not change dramatically over time. The

trajectory will depend on a number of unknown factors such as eastern hemlock health in the future, and whether more shade tolerant long-lived species like sugar maple have the ability to seed in from surrounding stands and grow slowly in the light-limited understory where other species are unable to persist. In the next 40 years, we will likely see much of the black birch component die out. The presence of large, vigorous seed-producing oak trees suggests we will see many small oak seedlings establish across the forest floor and some will survive to recapture the canopy of the future as individual trees are blown down or die from pathogenic causes.

Red Maple Wetland

On the western side of the Iroquois easement, there is a low-lying stand characterized mainly as a wetland.

Past: The stone walls surrounding the wetland portion of this stand indicate that this stand was cleared and previously used for cattle grazing. The stone walls were likely made to keep the cattle out of the wetland to prevent them from getting bogged down in the soggy conditions. The oak and shagbark hickory wolf trees present along the stone wall indicate this land was cleared. Furthermore, the eastern red cedar present upslope from the wetland indicates an old field was once there. The wetland does not appear to have been drained for crop agriculture as there is no sign of artificial drainage ditches.

Present: There is open water in the lowest areas of the wetland, and this area is occupied by red maple and slippery elm. Red Maple is the canopy dominant and is represented in many size classes, with a very vigorous pole-size class. Slippery elm (*Ulmus rubra*) is mainly seen as very small understory individuals with a few sporadic individuals of larger size classes. Moving away from the open water and upslope slightly, the species composition transitions to mixes that also include pin oak (*Quercus palustris*), shagbark hickory (*Carya ovata*); even further upslope to the north section of this stand, black oak and eastern red cedar (*Juniperus virginiana*) were observed.

Pole Bridge Red Maple	
Species	Basal Area (sq ft/acre)
RM	90
BB	10
SE	6.5
PO	3
SH	3

Table 7: Stand Level Basal Area Per Acre By Species

This stand is surrounded by private property, which has facilitated the successful establishment of invasives in the red-maple system. This has consequently affected the overstory just outside the wetland as Asiatic bittersweet (*Celastrus orbiculata*) has strangled and brought down multiple 30 foot tall trees. The gaps created by these tree falls are allowing invasive understory plants to further take over the site.

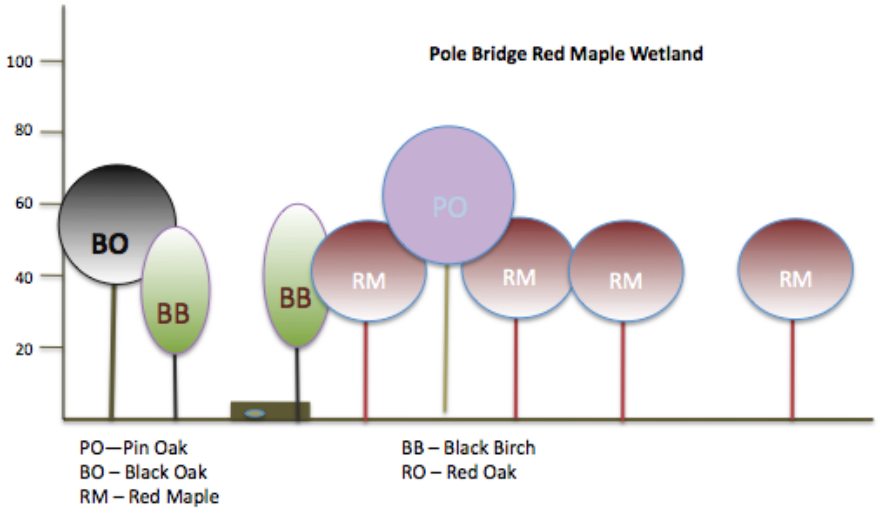

Figure 8: Schematic of Present Day Stand Structure and Species Composition

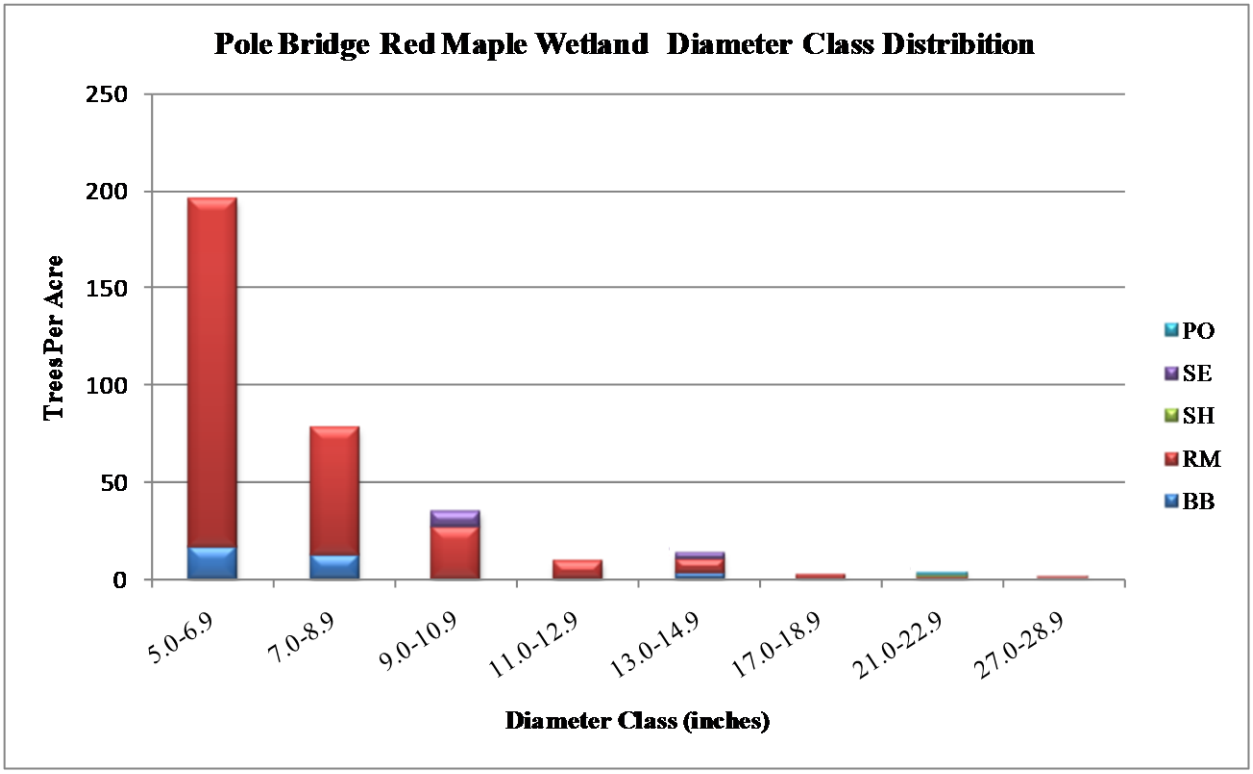

Figure 9: Stand level diameter class distribution by species

Future: The future of this stand will likely be continued dominance by red maple in areas with very hydric soils. In these areas, red maples will continue to grow to a certain height and then be blown down easily by the wind as their shallow root systems are not stable in the wet soils, making them susceptible to wind throw. Further, wind in this area is high due to the lack of

shelter by surrounding trees: there are open backyards surrounding the wetland, and the trees brought down by bittersweet will continue to expose the wetland further. Many tip-ups of red maples in the wetland were observed during sampling and this will continue into the future. Where tip-ups occur, hummocks[8] are created and these areas are great microsites for seedling germination since they are not water logged and confer a height advantage above lower lying areas. Therefore, these are likely areas where new red maples will re-establish and grow to reach the canopy.

There may be a slow xerification of this wetland as red maple trees transpire and reduce the moisture level of the soils such that in the very distant future the wetland may transition into a drier site that can be occupied by species such as pin oak, sugar maple, white ash, tulip poplar (*Liriodendron tulipifera*), and others that require moist but not hydric conditions. This may occur more rapidly if temperatures and drought continue to increase with climate change.

The Future of Pole Bridge Invasive Species: Invasive species at Pole Bridge pose a significant risk to the ecological system. Invasive species will dominate in the future at Pole Bridge. Japanese barberry is dominating the landscape in several areas where recently abandoned agricultural land exists. Given this condition, it is likely that barberry will spread at Pole Bridge. Other invasive may pose less significant ecological and/or economic threats at Pole Bridge.

Pond Brook Forest Stands

Hardwood-Hemlock Stand

Past: The large diameter hemlocks and hardwoods in the most northern section of the stand indicate that at least this part of the stand may not have been cleared for use during colonial settlement, and could be considered old growth structure. It is located close to the mill site and for this reason may have been untouched. Any plans to develop this area of Pond Brook should consider preservation of this old growth structure because of its rarity on the landscape. The remainder of the stand includes white oak and sugar maple trees as well as stone walls suggesting this area was cleared, but likely for grazing and not crop agriculture because of the microtopography present throughout.

Present: The stand is located on a western aspect and is therefore a drier site than the Red Maple-Sugar Maple stand as it receives the warm afternoon sun. However, the large hemlock grove is located on a moist northern aspect explaining the high hemlock productivity. We see a mix of canopy species including black, white and red oak, black birch, shagbark and pignut hickory, sugar maple, tulip poplar, white ash and eastern hemlock throughout the stand. Aside from the feature of large hemlocks, most hemlocks are currently in the subcanopy

Pond Brook Hardwood-Hemlock	
Species	Basal Area (sq ft/acre)
HM	50
BB	32.5
WO	20
BO	10
RO	10
TP	7.5
OTHER	25

Table 8: Stand level Basal Area Per Acre By Species

[8] A low mound or ridge of earth, higher than a surrounding marsh.

and understory, but are prevalent throughout the entire stand minus the most southwestern extent. There are large trees in this stand indicating that this is a productive site and also that these stands are likely approaching understory re-initiation. American beech and red maple are present as small diameter understory individuals only, and sugar maple and hickory individuals are prevalent as small understory individuals. Witchhazel and Ironwood (*Ostrya virginiana*) are found in the understory.

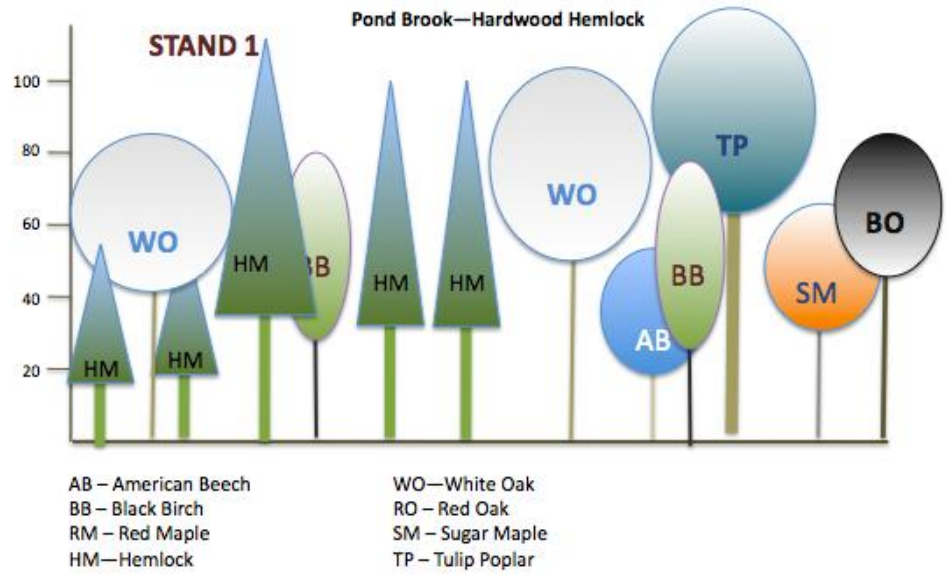

Figure 10: Schematic of Present Day Stand Structure and Species Composition

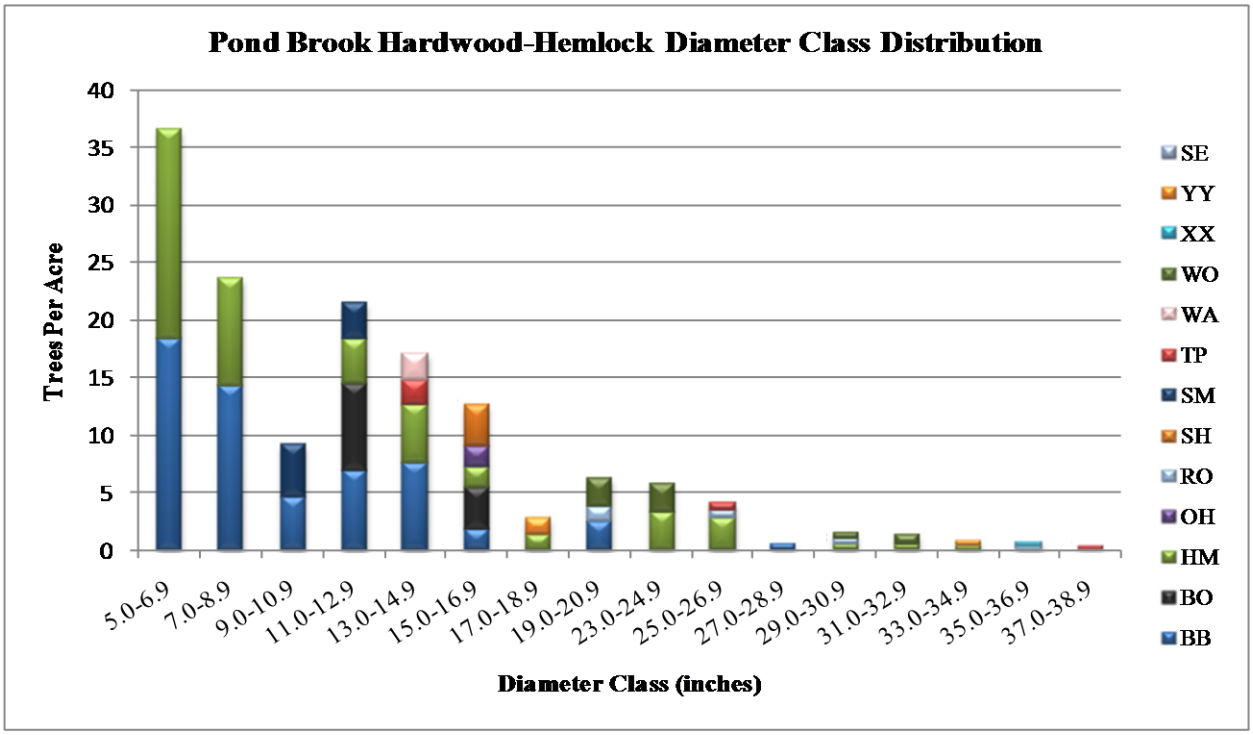

Figure 11: Stand level diameter class distribution by species

Future: This stand will transition towards a more shade-tolerant mixture of species, currently represented in the understory. A more shade-tolerant mix in the canopy will create greater stratification and will prevent the shade intolerants like tulip poplar, white ash and black birch from successfully establishing beneath the deep shade of such a canopy. Therefore, without a large disturbance, this stand will succeed towards a canopy further dominated by eastern hemlock, sugar maple, and later by American beech.

Red Maple-Sugar Maple Stand

Past: Several shagbark hickory and oak wolf trees were seen along the northern edge of the stand as well as along stone walls that run north-south through the stand. Several old apple (*Malus domestica*) trees were observed in the middle of the stand, suggesting that a home site may have been nearby and/or the site was previously an orchard. It is clear that this stand was an old field most recently before the current stand originated because of the presence of live and dead eastern red cedar individuals.

Present: This stand is located on a steep slope with a northern aspect. This orientation means the stand receives less light and is cooler and moister than other aspects, and partly for this reason, we see a sugar maple component. The stand is dominated by red maple in all size classes. Many small diameter eastern red cedar snags were recorded in sampling, along with several hardwood snags of relatively small diameters. These results support our observation that this stand is in mid stem-exclusion as a lot of fine woody debris was observed on the ground.

Pond Brook Red Maple-Sugar Maple	
Species	Basal Area (sq ft/acre)
RM	90
SM	7.5
YY	7.5
RO	5
XX	5

Table 9: Stand level Basal Area Per Acre By Species

This phase in stand development is characterized by intense competition with many trees losing the race and dying. These dying individuals have grown in dense conditions and therefore have small diameters, so dead wood accumulated at this time is almost exclusively of small diameter. As the stand ages, the trees that gain a height advantage over its competitors will survive and put on more girth.

A few minor species are represented in the stand but were not recorded in this sampling including big-toothed aspen (*Populus deltoides*), shagbark hickory poles, black birch, and black cherry. Musclewood, a true understory tree, was observed in sparse amounts.

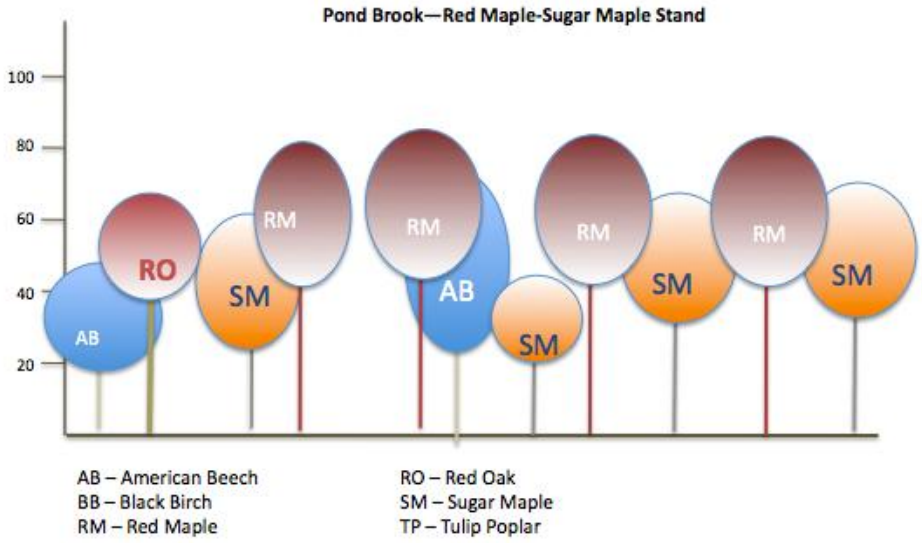

Figure 12: Schematic of Present Day Stand Structure and Species Composition

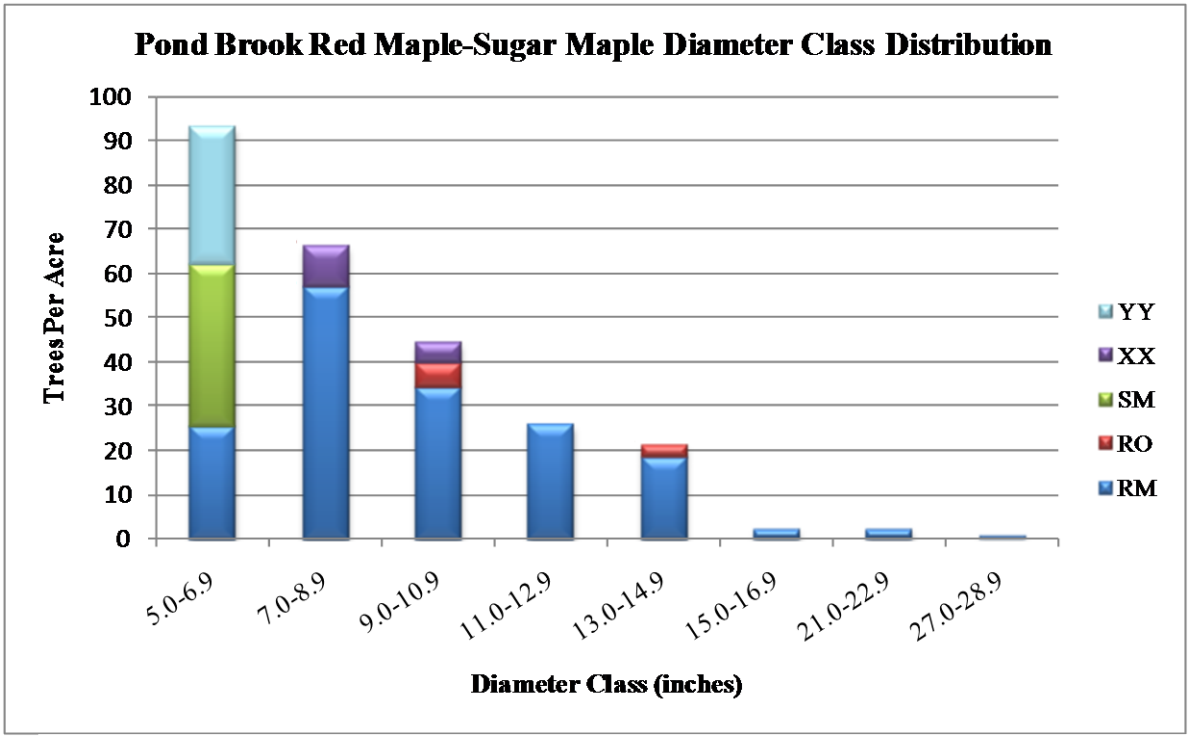

Figure 13: Stand level diameter class distribution by species

Future: This stand is younger than the surrounding stands and will take longer to develop into a mature forest. For this reason, the understory will have sparse vegetation for several decades. The north facing aspect of this stand creates moist conditions conducive to productive sugar maple growth; therefore the future canopy will be dominated by the sugar maple trees individuals currently in the understory and subcanopy. Alongside the sugar maple will be other minor hardwood components like shagbark hickory and oak species, particularly the mid-slope dwelling red oak.

Sugar Maple Stand

This stand is located in the northern section of the property, bordering the brook on the northwestern edge and bisected by the clearing created by the previous owner.

Past: The lack of soil horizons in this stand and the lack of microtopography suggest that it was tilled for crop agriculture. According to a neighbor, the pond that was created by the dam on Pond Brook broke in the 1955 floods. During its previous history the pond silted in after years of catching water that was flowing downstream. In 1955 when the dam broke, much of the lighter sediment washed downstream with the rushing water and created a deeply cut bank along this section of Pond Brook. This silting process explains why we currently see river bottom species American sycamore (*Platanus occidentalis*) and cottonwood (*Populus deltoides*) along the stream bank.

Present: High biodiversity is seen in the canopy with representation by tulip poplar, cottonwood, American beech (*Fagus sylvatica*), slippery elm, shagbark hickory, American sycamore, and white ash, among a few others. Many of these species are nutrient and moisture demanding species indicating that this is a productive site for tree growth. Sugar maple clearly dominates the stand with its high basal area but white oak is also a large component of the canopy. Given this stand's proximity to Pond Brook, it is very important to retain forest cover in order to maintain water quality, especially because the low amount of groundstory vegetation increases potential runoff. Due to the proximity of the brook to the headwaters at Taunton pond, this brook has the lowest water quality of all streams measured in the town (Rob Sibley, pers. comm.);it is extremely important to prevent the deterioration of this brook's water quality any further.

Pond Brook Sugar Maple	
Species	Basal Area (sq ft/acre)
SM	42.5
WO	17.5
RM	12.5
BB	12.5
RO	10
SE	10
AB	7.5
OTHER	15

Table 10: Stand level Basal Area Per Acre By Species

How forests affect water quality

- Forests act as infiltration sinks during rain storms to buffer against high overland flow of water
- Forests prevent erosion by holding soil on site, reducing sediments entering the water
- Forests capture ions and water soluble pollutants moving through soil water that otherwise would leach into and degrade water bodies

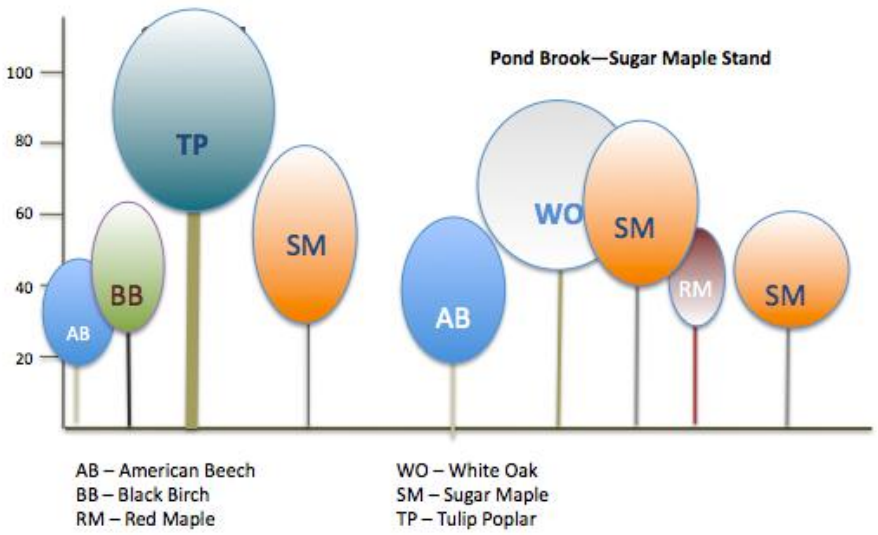

Figure 14: Schematic of Present Day Stand Structure and Species Composition

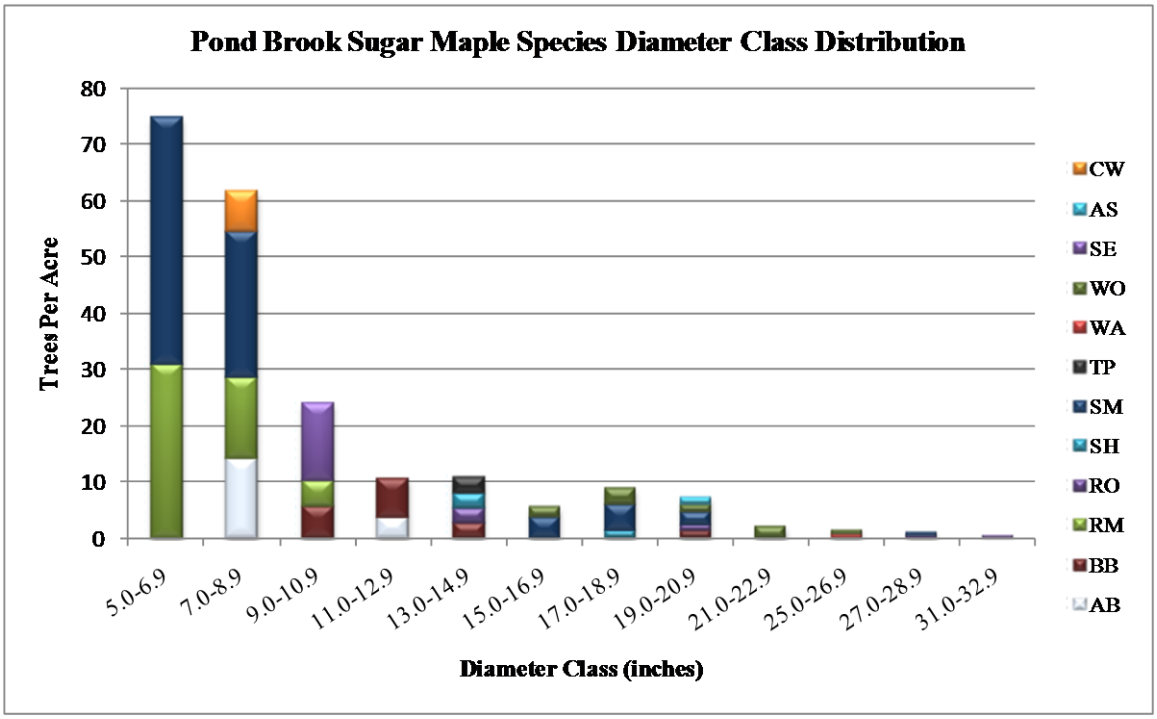

Figure 15: Stand level diameter class distribution by species

Future: Pioneer species like white ash, tulip poplar, and cottonwood will be unable to regenerate beneath the forest canopy and will exit the stand. American sycamore established under different soil conditions before the dam broke and will not be able to regenerate in this stand in the future. Sugar maple will gain canopy dominance and even further in the future, the canopy will see American beech as a main representative. Oaks and hickories will likely continue as minor

representatives. Senescence of the large diameter pioneers present will improve roughness at the forest floor, increasing water infiltration and decreasing runoff into the brook.

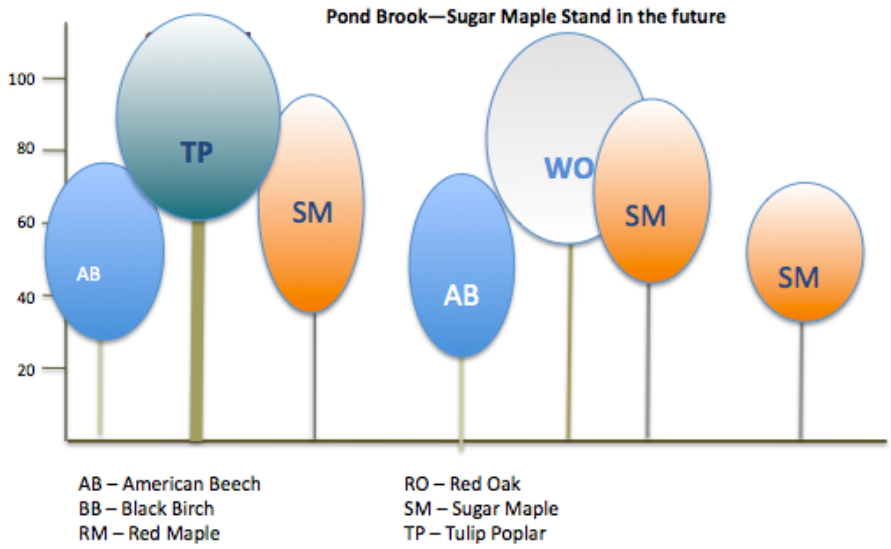

Figure 16: Schematic of Projected Stand Structure and Species Composition in the Future

The future of Invasive Species at Pond Brook: Invasive species at Pond Brook will continue to encroach. As the site conditions for tree of heaven in the meadow environment are excellent, it is possible that this species could gain a foothold. Japanese barberry will continue to encroach and thicken in the southwestern portion of Pond Brook. Euonymus will likely be dispersed in the understory and multiflora rose will likely have the lowest representation of the invasive species contingent.

Stone Bridge Forest Stands

Oak-Hickory Stand

The species composition varies slightly across the parcel but the site can be classified as one Oak-Hickory stand with two red maple wetland features.

Past: The lack of stonewalls on this property and the presence of charcoal in the soil horizons indicate this property was primarily used for charcoaling. The hardwood trees of the previous stand were harvested and have re-sprouted to form multiple stemmed trees present throughout the property. The former stand's species composition may have been slightly different, particularly before the chestnut blight (*Cryphonectria parasitica*) eradicated any canopy-dwelling American chestnut (*Castanea dentata*) trees. There may have been more late-successional trees of American beech and sugar maple in the canopy alongside the oaks.

Present: Red oak is the major canopy dominant across the entire parcel, with variable representation by black oak, chestnut oak (*Quercus prinus*), hickory, tulip poplar, sugar maple, red maple, yellow birch (*Betula alleghaniensis)* and black birch.

Stone Bridge Oak-Hickory	
Species	Basal Area (sq ft/acre)
RO	52.9
TP	15.7
RM	12.9
BB	12.9
BO	10
YB	10
OTHER	15.9

Table 11: Stand Level Basal Area Per Acre By Species

Red oak is most dominant east of the gas pipeline that bisects the parcel. Here, chestnut oak and black oak are minor canopy dominant species, and some American beech occurs in the subcanopy. Black birch, pignut and shagbark hickory, white oak and yellow birch are also present as minor components of the canopy. The small diameter classes (less than 5 inch diameter at breast height) are dominated by American beech, red maple, sugar maple and hickory. There are a few small American chestnut individuals in the understory. These have regenerated as sprouts from old chestnut stumps that were either harvested before the chestnut blight arrived or from an individual that was killed by the blight itself. Therefore, they denote the exact location of a chestnut tree before the blight devastated mature chestnut trees since the blight continues to suppress all chestnuts from reaching maturity.

Red and black oak seedlings are present, and witch hazel is seen growing to 15 feet high. This section comprises the most drought tolerant species at this site, which connects well to the topography of the site.

West of the gas pipeline, there is more variability in species composition. A small red maple wetland dominates the low lying area close to the southern extent of the property. Red maple is the major canopy representative, with American basswood (*Tilia Americana)*, and yellow birch present in the canopy at the wetland fringes. Slippery elm is present in the understory as small diameter individuals.

Surrounding the wetland and moving north to higher areas, there is a sharp transition to a red oak and tulip poplar dominated canopy. Black oak, black birch and a few other intermittent species are present in the canopy as well. Yellow birch, hickory, American beech, and red maple are present in the smallest diameter size classes. Muscle Wood (*Carpinus Caroliniana)* and Witch Hazel (*Hamamelis virginiana*) are major components of the understory. Red and Black oak seedlings are littered throughout the forest floor.

Moving towards the northwest corner of the stand towards the drainage, the composition shifts to a red oak and sugar maple dominated canopy, with a vigorous sugar maple understory. Also, a second red maple wetland is encountered at this low-lying northern property extent and crosses the parcel boundary into the adjacent property.

Yellow birch is seen across this site, even in association with chestnut oak- a species with very different environmental tolerances. Yellow birch is generally found on cool, moist sites in Connecticut as it is at the southern limit of its range, whereas chestnut oak is generally characterized as a ridge top species due to its ability to tolerate drought conditions. It is remarkable that these species are growing together vigorously in this stand.

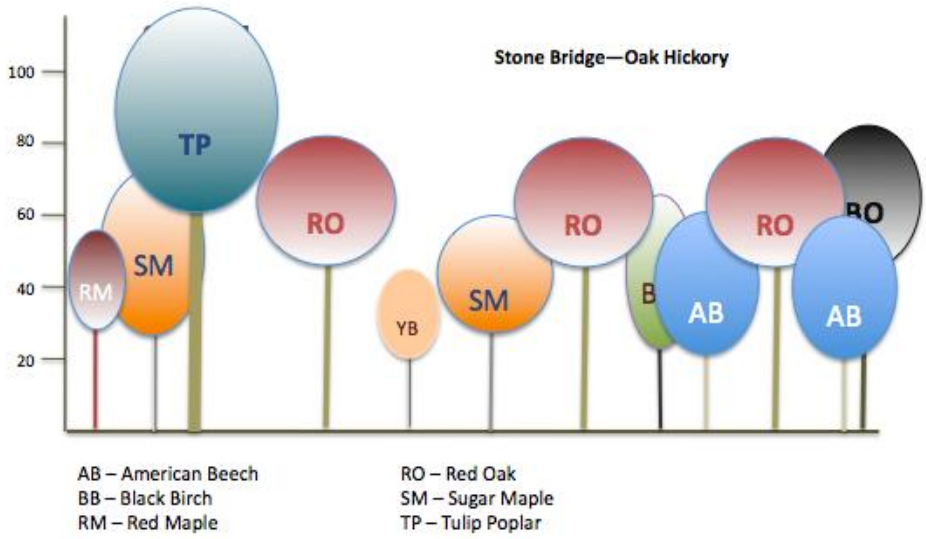

Figure 17: Schematic of Present Day Stand Structure and Species Composition

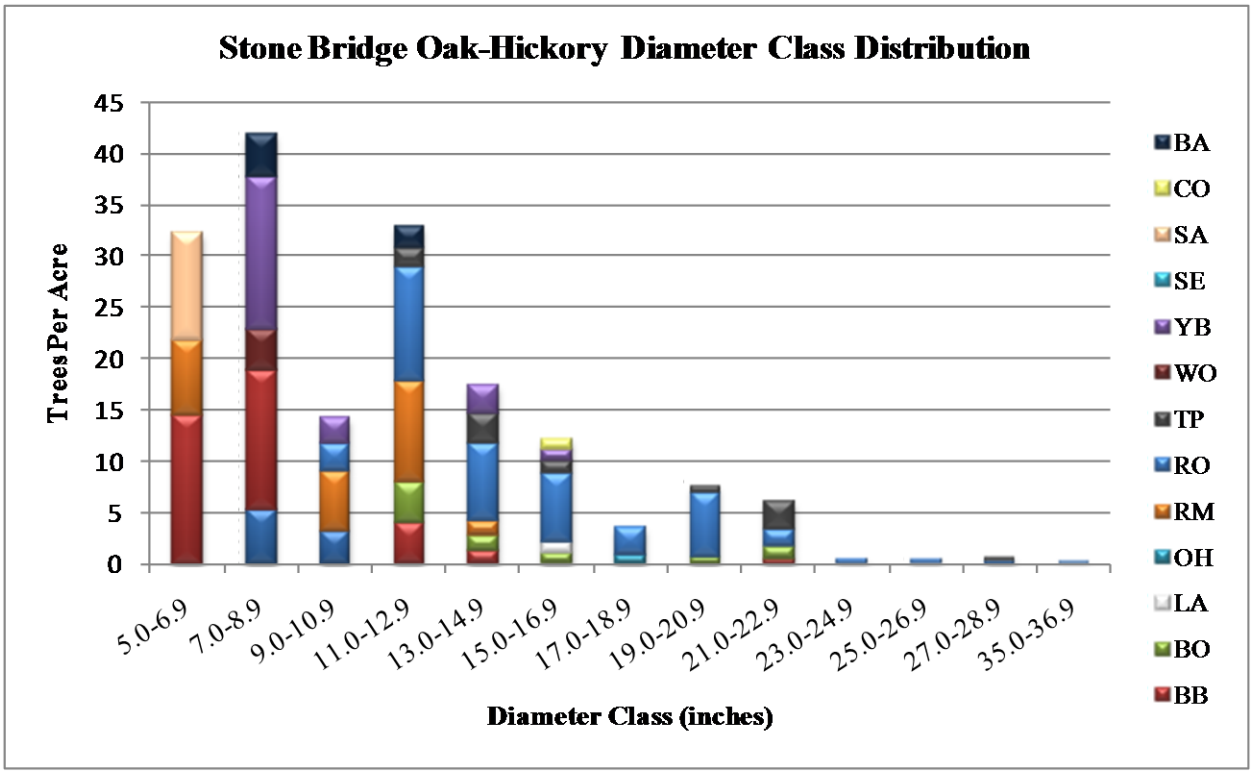

Figure 18: Stand Level Diameter Class Distribution by Species

Future: Red oak currently dominates the canopy, and is represented at multiple size classes. However, red oak individuals in the smaller diameter classes are suppressed and will likely exit the stand in the next several years. The tulip poplar currently occupies the top 'emergent' stratum, well above the rest of the canopy but due to its light-demanding properties, this species will have a hard time regenerating in this stand if large gaps are not created.

A fair amount of pit and mound topography was observed on the western side of the gas pipeline, as well as a group of wind thrown trees. Trees in this western half are more susceptible to wind throw due to their shallow root systems in the moist soils. Due to this greater susceptibility in this western half, we may see larger gaps created by multiple tree falls at the same time. These larger gaps may allow some of the less shade-tolerant species like black birch, sassafras and tulip poplar to remain as components in the future canopy of this stand. However, in general the stand will transition to a more shade tolerant mixture in the canopy dominated by sugar maple and American beech.

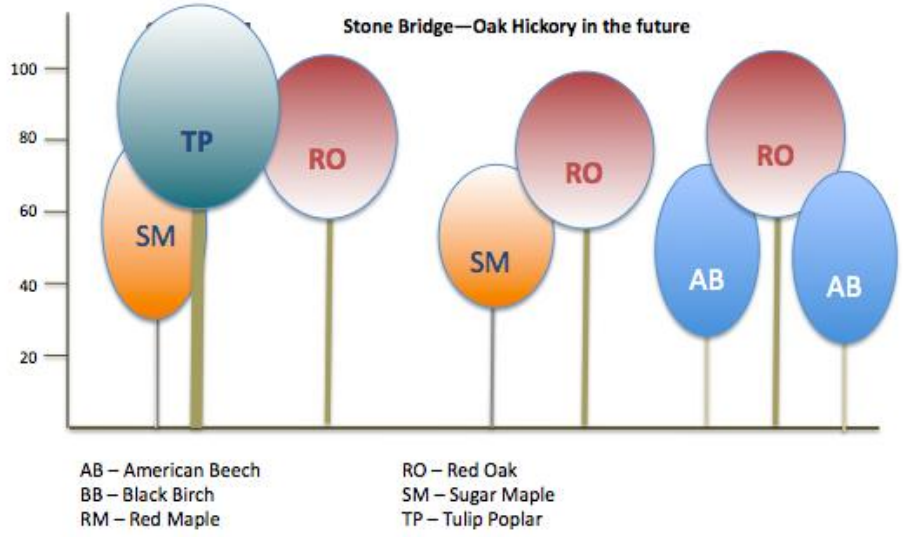

Figure 19: Schematic of Projected Stand Structure and Species Composition in the Future

B. TREE REGENERATION RESULTS AND INTERPRETATION

Seedling and sapling populations are low in most stands. There was one sapling (defined as a tree greater than 1 foot in height but less than 1 inch in diameter and less than 4.5 feet in height) recorded in all 35 plots sampled across the three properties, and this paucity of sapling presence is consistent with our qualitative observations[9]. The one sapling recorded was a chestnut oak sapling in the eastern half of the Stone Bridge property. This record is consistent with the trend

[9] Due to the sampling methodology employed, tree regeneration may be overrepresented in the results. These tables should be read as a graphical representation, not as a precise description of the seedling and sapling populations.

that chestnut oak was the most abundant species of sapling size we observed, and saplings were most abundant at Stone Bridge, albeit still low.

Seedlings (defined as a tree smaller than 1 foot in height) recorded in the Pole Bridge Mixed Hardwood stand include slippery elm, hickory, American beech, and red oak. In most cases, seedlings recorded were limited to only one individual per species during quantitative sampling. The highest seedling density recorded during our qualitative observations was in the western section of Stone Bridge away from the wetlands where pockets of the forest floor are littered with red and black oak seedlings. Many of these individuals have germinated in the past year as this past year was a year of large seed production for red and black oaks, the largest seed production in the area since 1993. However, some seedlings do have a woody stem suggesting that they germinated in a prior year (possibly 1993) and have been surviving in the understory, awaiting a gap to open up and create a higher light environment for growth.

Stand	Seedlings Per Acre	Saplings Per Acre	Species
Pole Bridge Hemlock-Hardwood	0	0	
Pole Bridge Mixed Hardwood	5900	0	Slippery elm, hickory, American beech, and red oak seedlings
Pole Bridge Oak	0	0	
Pole Bridge Red Maple	460	0	Black birch seedlings
Pond Brook Hardwood-Hemlock	345	0	Black birch seedlings
Pond Brook Red Maple-Sugar Maple	0	0	
Pond Brook Sugar Maple	0	0	
Stone Bridge Oak Hickory	3950	200	Red oak, black oak, black birch, sassafrass, and red maple seedlings; chestnut oak saplings

Table 12: Tree Regeneration by Stand. Seedlings are defined as tree species less than 1 foot in height and saplings are defined as tree species taller than 12 inches in height but shorter than 4.5 feet and 1 inch diameter.

As described in the overstory section, most of the forested stands are in the late stem exclusion phase of stand development, when the light conditions at the forest floor are at their lowest. This partly explains why tree regeneration is very low in most stands. A second factor that may be contributing to the low seedling and sapling populations recorded is deer herbivory. Since Stone Bridge is contiguous with state land where permitted hunting occurs, it is possible that deer populations are lower at this property than the other two town properties being studied. If this is true, lower deer related herbivory would be expected at Stone Bridge and therefore we would expect higher tree regeneration here than at any other site. While tree regeneration at Stone Bridge is high relative to the other sites, recording the second highest regeneration levels of the 8 forest stands, it is not possible to make the direct correlation that higher tree regeneration is caused by lower deer herbivory. Each stand has its own distinct set of site conditions that affects productivity and regeneration potential, as well as distinct vegetation types, and land use history.

It is likely that all of these factors contribute to the paucity of groundstory vegetation, but it is unknown how much each contributes at this time. This should be kept in mind when making decisions about how to approach deer management and forest health issues.

C. NON-FORESTED UNITS RESULTS AND INTERPRETATION

Three manmade non-forested units are present at the properties. All of them are more or less in the form of a corridor because of their desired purpose when created. This shape creates a high edge to interior area ratio that has ecological impacts discussed in this section and in the wildlife section that follows. Based on the qualitative observations collected during sampling in these 3 units, conclusions about their conditions and interpretations about the future are described in this section.

Stone Bridge Maintained Iroquois Gas Pipeline Transmission Systems Easement

The Iroquois easement is a maintained corridor that passes through the Stone Bridge parcel and essentially splits the property in half. While this clearing only comprises 1.2 acres of this 34.4 acre parcel, it has considerable ecological impact to the surrounding forest system. The amount of forest edge increased significantly once this clearing was created altering vegetation communities and wildlife habitat.

Stone Bridge Species Observed in Open Stand	
Ragweed	Trefoil
Rubus species (raspberry, strawberry)	Virginia creeper
Milkweed	Sweet Fern
Whitewood aster	Chestnut and white oak seedlings
Eastern red cedar and black birch saplings	Maple-leaf viburnum
Asiatic bittersweet	Japanese barberry
Tree of Heaven	Winged Eunoymus

Table 13: Species Observed in Mowed Area and Along Edges of the Gas Pipeline Easement

The most striking observation is the unrestrained spread of invasive plants along the edges of the clearing. Since this easement is mowed once every 3 years or so and was planted with nitrogen fixing leguminous ground cover, invasive and native plant establishment within the managed area have been minimized. However, outside this mowed area along of the periphery of the closed forest these invasive species are vigorously growing. Most of these species are light demanding and will not stray too far under the closed canopy where light limits their growth.

The eastern edge appears to be older and the vegetation is more mature than the western edge as the western edge has an abrupt transition from forest to the mowed area. The more southwesterly facing aspect of the eastern edge may also be stimulating more productivity as it receives the warm afternoon sun. Because sunlight comes from the south, the gap allows light to reach into the forest for a portion of the day and this may help to stimulate forest regeneration in the future.

Pole Bridge Maintained Iroquois Gas Pipeline Transmission Systems Easement

The maintained easement at Pole Bridge is found along the town property boundaries, south of the Hemlock-hardwood and Oak stands and north of Red maple stand. Because it is located along property boundaries instead of crossing straight through a property, its impact isn't as severe as that seen at Stone Bridge where an intact forest stand is effectively severed in half. Here, the political boundaries created a mosaic of land use histories that have now generated different vegetation types where there was already an edge to speak of between these properties. However, the creation of this gas pipeline amplified the edge effect by creating a sharp edge of very contrasting cover types (open clearing versus closed forest). As with Stone Bridge, this easement is mowed periodically and therefore will not return to forest. However, this easement is narrower than Stone Bridge's and more natural meadow vegetation has been allowed to encroach into the easement so the cover type is more dominated by natural vegetation than planted grasses.

Pole Bridge Species Observed in Open Stand	
Rubus species (strawberry, raspberry)	Ragweed
Clover	Vetch
Plantain	Golden rod
Dandelion	Milkweed
Indian paint brush	Green fox tail
Peen smart weed	Garlic mustard
Winter rye	Eastern red cedar saplings
Aster	Autumn olive
Asiatic bittersweet	Multiflora rose
Invasive sedge	

Table 14: Species Observed in Mowed Area and Along Edges of the Gas Pipeline Easement

Asiatic bittersweet was found in this area, and could be a growing concern considering the large seed source coming from the nearby Red Maple stand and the forest edge conditions conducive to bittersweet growth. These factors cause some concern for the future of the forest edge trees, and the easiest way to address this would be to control the bittersweet population in the Red Maple stand.

Pond Brook Cleared Meadow

This open meadow has high early-successional species diversity and, despite the unsavory conditions under which it was created, provides many benefits for wildlife. Open meadows have become rare in New England as land use has intensified and space has become limited- it has become too expensive or is deemed wasteful to leave land as an open meadow. These habitats are necessary for many wildlife species as is discussed in the wildlife section.

Many herbs and grasses were observed here but not at the other two properties. Most of these species are light demanding and prefer disturbed sites, therefore they may be lost overtime unless the meadow is managed to maintain its early-successional state. Table 15 identifies the species observed during sampling.

Pond Brook Species Observed in Meadow		
Rubus species (strawberry, raspberry, blackberry)	Aster and woodland aster	Black birch seedlings/saplings
Wooly mullen	Ragweed, rye grass, yellow nut sedge	Eastern red cedar seedling
Greenbrier	Deer tongue	Poison Ivy
Spirea	Wild carrot	Queen Ann's lace
Pennsylvania sedge	Christmas fern	Pokeweed
Goldenrod	Fungi: Coprinus, bracket polyplore, turkey tail	Tree of heaven saplings
American beech along the meadow/forest edge	Red and sugar maple saplings	Spicebush
Multiflora rose	Japanese barberry	Asiatic bittersweet
Garlic mustard	Winged euonymus	

Table 15: Species Observed in Open Meadow

Because of the past logging at this site, many wood piles were created inadvertently but their presence is positive as they add surface roughness to help increase water infiltration and they are wildlife habitat for many species.

This meadow generally has a north facing aspect keeping it cool and moist. For this reason, productivity in this meadow may not be as high as it could if it were south facing, and it may prevent species at their northern range limit from establishing here. Conversely, species at their southern limit will thrive at this site. If the meadow were left alone it would return to a forest eventually, possibly in a few decades, but because of the north aspect it may take longer than expected for the canopy to close.

D. UNDERSTORY SPECIES COMPOSITION

Overview

Light and water are limiting factors in forest understory. In the northeast, hardwood forest species have diverse roles. Understory species composition is impacted by the geology, hydrology and cover types as previously discussed. Light filtering through the canopy is a limiting factor in the regrowth of understory species. Furthermore, while contiguous forests are healthier for wildlife, forest gaps are also important in allowing for the influx of light to the forest floor. Light is necessary for photosynthesis and while some species are shade tolerant while immature they can be sun tolerant while adult. Some species wait for a forest gap to be created by the death of a diseased tree or catastrophic event such as a storm. Characteristics of a healthy forest are the lack of invasives, the presence and relative abundance of a diversity of

species and the lack of disease. Understory species produce wet and dry mast[10] as food for wildlife. While this survey included woody and herbaceous understory plants it was limited by the time of year in which the survey was performed in the months of September through November in 2010.

Species found in the forest understory survey included many that are considered food for wildlife. Other species in the survey indicated presence and absence of wetlands. Bryophytes that were found at some sites indicate a presence of good soil fertility and a relatively undisturbed site. While some species that were encountered were not represented in the quantitative survey they were accurately accounted for in the qualitative survey. For instance- Pond Brook was surveyed by cover type. One of those cover types was a meadow that traversed the property. The meadow had downed trees and a multitude of plants with wet mast including black berry and raspberry. These plants, while not represented in the quantitative survey support wildlife at Pond Brook, were accounted for in the qualitative survey. See the supporting data in the quantitative section within the narrative expressed below.

Each forest varied in its understory constituents. Some invasive species were present. The forest biodiversity is a reflection of its ability to support wildlife and recycle nitrogen in the forest. Pole Bridge exhibited the most diversity. This can be explained by the variety of cover types present. Upland and lowland areas were reflected in species composition. At Stone Bridge, the oak-hickory forest was interspersed with plants in the understory that required little sunlight. In as much as mainly native species were found in this location, invasives were also found on the site. Most likely these invasives radiated into the site from neighboring lands. Pond Brook saw a diversity of plants that were not well reflected in the quantitative survey. The quantitative data for this area included the forest cover, the meadow was accounted for qualitatively and it supports a rich diversity of birds and rodents. A rich diversity of species was present across all Properties.

The understory at each of the locations has less diversity than desirable. This is due to past land use. In the forests of colonial New England a high diversity of ephemeral plants and understory species were represented. Then clearing of the land and agricultural practices disturbed the ecology of the area. This action combined with the non native species that became present on the landscape altered the ecology of the area. The returning of the forest to a period of stem exclusion limits the light available to understory species. As the forest returns to understory reinitiation, as discussed in the stands section of the report, understory species will receive more light due to death in the overstory species. This influx of light will propagate species that have not been seen on the forest floor during stem exclusion.

[10] Foresters refer to mast as fruit (nuts, berries, drupes) that are consumed by wildlife. Hard mast includes hickory nuts; soft mast includes raspberries and blackberries.

Approximate Cover Per Acre (Ft.^2/Acre) Species	POLE BRIDGE	POND BROOK	STONE BRIDGE	TOTAL
	Approximate Cover Per Acre (sq ft/acre)			
Arrow Wood	1270.5			1270.5
Aster	145.2			145.2
Canada Mayflower			186.69	186.69
Christmas Fern		5445		5445
Geranium	145.2			145.2
Golden Rod	1089			1089
Green Briar	544.5			544.5
Ground Cherry	544.5			544.5
Hay Scented Fern		544.5		544.5
High Bush Blueberry			311.14	311.14
Low Bush Blueberry			1555.71	1555.71
Lycopodium	108.9		373.37	482.27
Maple Leaf Vibernum		217.8	808.97	1026.77
Moss	26862	544.5		27406.5
Muscle Wood		544.5		544.5
Ostrich Fern	1452			1452
Partridge Berry	108.9		62.23	171.13
Penn. Sedge	9801	1742.4	435.6	11979
Pepper Bush			1555.71	1555.71
Poison Ivy	108.9	108.9	62.23	280.03
Raspberry	145.2			145.2
Royal Fern			311.14	311.14
Sasperilla			311.14	311.14
Skunk Cabbage	726			726
Sphagnum Moss	108.9		3111.43	3220.33
Spice Bush		544.5		544.5
Spirea	145.2			145.2
Violet	290.4			290.4
Winterberry		108.9		108.9
Wintergreen	326.7		186.69	513.39
Witch Hazel	108.9		373.37	482.27
Yellow Loosestrife		108.9		108.9
Site Total (sq ft/acre)	**44031.9**	**9909.9**	**9645.43**	

Table 16: Herbaceous Cover Among Native Forest Understory Plants

Pond Brook Understory Species Composition

Pond Brook understory species were surveyed using quantitative and qualitative methods. The presence of Christmas fern here indicates a wet area (in fact, there is a stream and several drainage areas nearby). Spice bush, common in this area, is an indicator of a healthy ecosystem. While the understory at Pond Brook was diverse it has been modified by the anthropogenic factors. Understory species seen on the upslope of the property to the east of the meadow were species that are indicators of early successional habitat. Furthermore, species that were present that include invasives also show the presence of man and the use of equipment that spreads such species. The diversity and abundance of native understory plants is strong and this site shows elements of a healthy system that supports birdlife and other wildlife.

Pole Bridge Understory Species Composition

Pole bridge shows a diversity of plant life in the understory. It contains a variety of plants that have wet and dry mast. It also shows plants that are from a variety of cover types. Some plants have associations with others that encourage their presence in the landscape. Ferns aid in preventing soil erosion. Raspberry, arrow wood and green briar all produce mast for wildlife. The understory here is representative of a variety of habitat types. In association with oak and hemlock dominated stands a mixture of species create an availability of food for wildlife not found in other sites. The total coverage of these plants over the acreage of the property is significant. While many of the plants that are present are shown to be good mast for animals they also prevent soil erosion. The availability of water to the plants is not a limiting factor and many species seen in this survey were those that are shade tolerant while immature and mature. There were no endangered species present. Wintergreen and lycopodium do not prefer disturbed sites. As indicators it is likely that these plants would need to be present in order for those more sensitive to grow in association with them.

Stone Bridge Understory Species Composition

Species that are observed at stone bridge included those that are indicators of wetlands and of mesic uplands. Skunk cabbage was found in the bottom southwest corner of the parcel. In the upland areas of the center of the parcel there were plants that were representative of well drained soil that also support wildlife. This area's understory was open and included plants that grew on the forest floor such as ferns, wintergreen and sedges. The species found in this area were limited by light exposure. The forest understory is receiving little light. As a result, some of the more light sensitive plants like spice bush were not present. However, this forest showed the least amount of invasive species as compared with Pond Brook and Pole bridge. Overall this forest qualitatively measured the most aesthetically pleasing although some light could be introduced in the forest to encourage understory species.

E. INVASIVE SPECIES

Both plants and insects are contained in this category of the report. Plants that are non-native have been introduced along the timeline of American history. For instance, multiflora rose was introduced to help stop erosion. Since then it has escaped and naturalized and now survives and reproduces in the landscape. It persists once established. Japanese barberry is another shrub that was introduced and has naturalized. This species along with many other berry producing shrubs are dispersed by birds. Insects can also be termed invasive species. Both plants and insects create forest health problems and while considered invasive species dually affect the forest. Insects that are invasive sometimes feed on specific trees. The wooly adelgid feeds on the eastern hemlock. The Asian long-horned beetle feeds on hardwoods of North America. It was introduced and spread rapidly. The emerald ash borer is the next great threat to Connecticut *fraxinus* species. The below sections will discuss invasive species as related to plants and insects.[11]

Plants

Pole Bridge showed the highest amount of diversity and area of invasive species in the landscape. As compared to Pond Brook with somewhat less, their comparative makeup is nearly the same. Pond Brook showed less bittersweet. Pole Bridge showed more Japanese barberry. Winged euonymus was present in larger amounts at Pond Brook. Garlic mustard was present at Pond

Figure 20: the red shrub in this picture is Japanese barberry. An invasive species, it makes up a large component of the forest understory invasive species surveyed among all properties.

[11] For a list of invasive species fact sheets see the appendix.

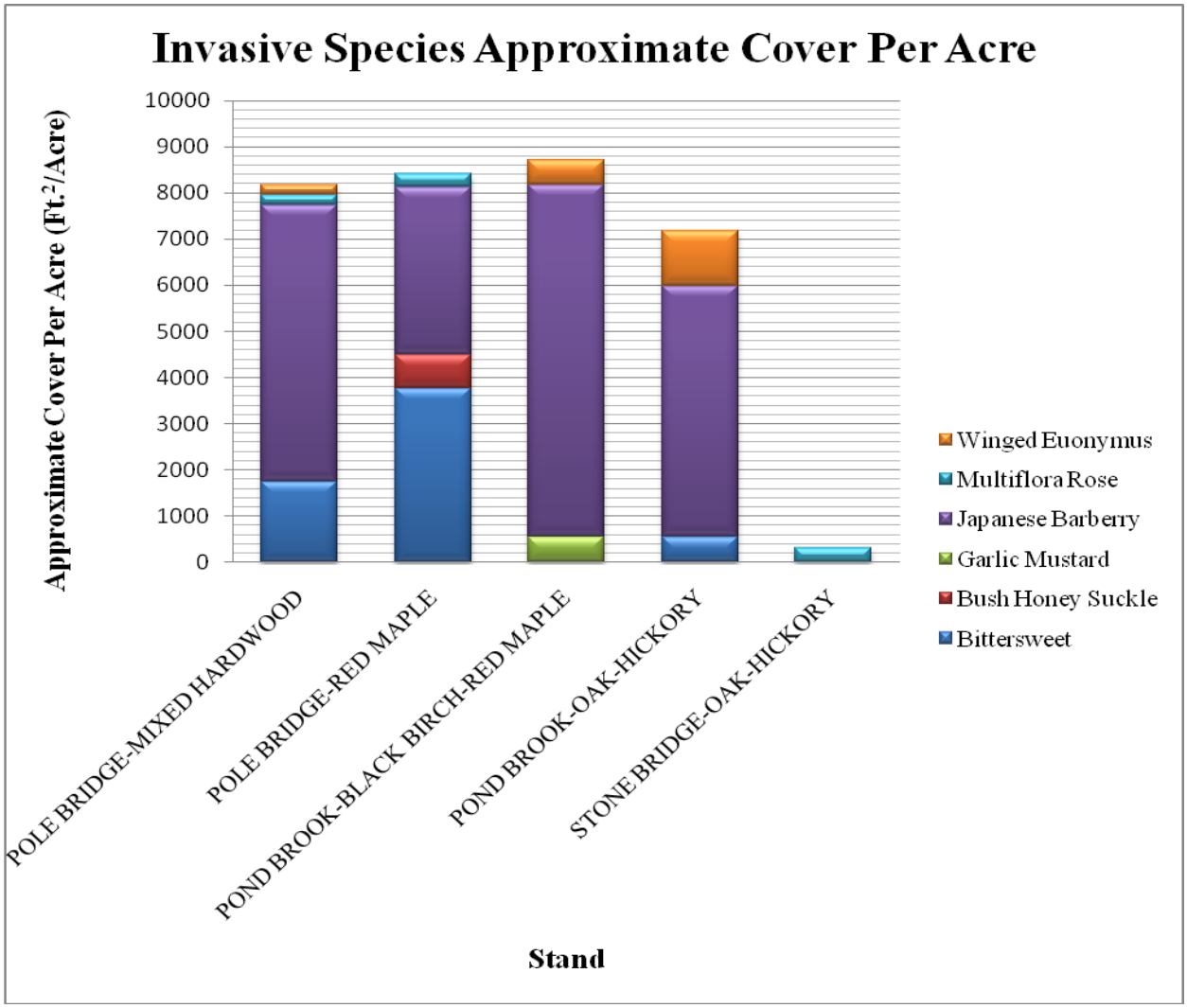

Table 17: The table above shows the distribution of invasive species in the stands. Management can be better targeted using the above chart for emphasis of control.

Approximate Cover Per Acre (Ft.^2/Acre) Species	POLE BRIDGE	POND BROOK	STONE BRIDGE	Grand Total
Bittersweet	5517.60	544.50		6062.10
Bush Honey Suckle	726.00			726.00
Garlic Mustard		544.50		544.50
Japanese Barberry	9619.50	13068.00		22687.50
Multiflora Rose	508.20		311.14	819.34
Winged Euonymus	217.80	1742.40		1960.20
Grand Total	**16589.10**	**15899.40**	**311.14**	**32799.64**

Table 18: This table shows the distribution of invasive species among the stands. Total square footage is estimated from quantitative survey methods. The approximate area is defined for each sites acerage. See Table 17 for stand information.

Brook and Pole Bridge but was not as abundant in the latter site. Pole Bridge saw the most multiflora rose. This site also showed the least amount of invasive species. One reason for this is the lack of disturbance at the site. However, with Iroquois Pipeline being present and mowing occurring, it is likely that invasives will be present in the future. Stone Bridge also has the least amount of disturbance overall. Its understory is the least likely to receive sunlight. Invasive species have compensated for this strategy with a longer photosynthetic time period so establishment of invasive over natives is likely.

Japanese Barberry was planted as an ornamental and was widely used as food for birds during the early part of the 20th century. Since then it has escaped cultivation by aid of bird transport and established itself successfully in the southern forests of New England. That success is partially due to its ability to persist and thrive in low light forested condition. As a fruit it has a small red drupe. It has thorns at the leaf axils and is irritating to wildlife such as deer. Japanese Barberry also provides a higher moisture regime aiding the early part of the black-legged tick (*Ixodes scapularis*) lifecycle thought to be aiding in the spread of Lyme and other tick-borne diseases. Barberry is not a choice food for birds. This is most likely due to the lack of history between the birds of the area and the more recently introduced barberry. Given time it is likely that barberry will be atop the list of food preferences for birds. Barberry is a low growing shrub. It is present on adjacent lands in more populated amounts. These adjacent lands are seed sources for Japanese barberry and some education may be required for the successful management of Japanese Barberry on the contiguous landscape.

Garlic mustard (*Alliaria petiolata*) was brought by settlers to North America. It has since been established in the eastern United States and southern Canada. It has aromatic stems when crushed. It was thought to have some medicinal value although no confirmation is present. It grows along stream banks and in most areas and can exclude other plants from the area by its growth habit. It can be controlled with a weed whip, scythe or by hand pulling.

Multiflora rose (*Rosa Multiflora*) is a shrub in the rose family. This species was introduced to prevent erosion on highways and byways of the eastern United States. It has since naturalized and become part of the landscape in America. It has white flowers and can quickly dominate the landscape. It prefers edge habitat and can grow to be 10’ high and occupy a large amount of square footage. It reproduces by hips. It is spread by equipment during mowing or in soil transport. It can be controlled by pulling, cutting and lethal herbicide.

Bush honeysuckle (*Lonicera japonica*) is wide spread in the landscape and holds its leaves longer into the season when other deciduous plants lack foliage. This trait gives bush honeysuckle an advantage over other plants. It bears a small red berry and is dispersed by birds.

Winged euonymus (*Euonymus illata*) is also dispersed by birds. Otherwise known as burning bush this species is shade tolerant. It escaped cultivation and is now widespread in the forests of the south and northeast. Winged euonymus was widely observed in the survey. This species makes up the second most prolific invasive species in this study. It was found near adjacent properties and is suspected to come from seed sources outside the parcel boundaries indicated in this study.

Asiatic bittersweet (*Celastrus orientalis*) is a vine. Here in Connecticut there is a native bittersweet. It can be found growing along farmland fences in rural areas. However, it is becoming hybridized with this non native species. Our native species produces a fruit similar to the Asiatic variety aside from the location of the flowers. Flowers in the native variety appear at the apical meristem of the plant. The non native variety flowers more prolifically and its flowers are borne in the axils of the plant rather than at its apices. Control measures include cutting and applying herbicide to the cut stump. This is the most effective means of control.

Norway maple (*Acer plantanoides*) was also found at Pole Bridge and was represented in the quantitative survey. This species is fast growing as compared with other maples and prefers similar site characteristics. It is a large tree that spreads by wind. Usually it is found in forests in urban areas. However, if a tree is introduced as an ornamental in the landscape it can quickly populate an area over the course of 30 years. Control measures include girdling old trees and using the cut stump treatment with younger poles and saplings.

Russian olive (*Eleagnus angustifolia*) was found at Pole Bridge and was not represented in the quantitative survey but was present in the qualitative survey. This species flowers and fruits prolifically. Furthermore, it is a choice edible for berry eating birds. The fruit is a drupe containing one seed and its flesh has a high sugar content perfect for mobilizing energy during bird migration. This species is a shrub and can be controlled by cutting and application of a systemic herbicide.

Insects

Insect invasive species have caused damage to this region's forests. Over the course of the last century we saw the introduction of the gypsy moth caterpillar, where in the early 1980s it defoliated several million acres of trees between New York and Maine. The Asian long-horned beetle has invaded and its ability to cause damage to hardwoods has prompted the creation of quarantined sections of the country. Officials are hoping to slow the spread of the species. Insect invasions alter the ecosystem by removing plants that were vigorous and provided good seed for the regeneration of the forest. Some trees do end their life after infestation by insects as snags.[12] However, too many snags in the landscape are not beneficial. Discussed below are the major insect pests to be found during recent invasions. The future of this region's forests is an infestation of ash trees by the emerald ash borer.

Figure 21: This snag was created by a diseased tree dying. It provides habitat for wildlife. Insects, fungi and storms can cause snags.

[12] Standing dead trees

F. WILDLIFE AND HABITAT

Snags

Snags have been recognized as a critical component of forest ecosystems (Doyon et. al 1999). Structural heterogeneity provided by standing woody debris and old trees increases biological diversity in forest ecosystems (Gregory et al 1999). While amphibians use decaying dead logs as habitat for breeding, standing dead wood offers birds sites for nesting and feeding (Loeb 1996). Retention of standing dead wood offers wildlife habitat and diversity in forest composition. The Forest Guild recommends five snags with a dbh (diameter at breast height) of 10 inches or greater per acre (Forest Guild 2010**).** As the stand ages, more trees senesce, rendering more snags in the landscape. Our study showed Pole Bridge with the most snags. The amount of snags is most likely due to the presence of Hemlock in the stand. Stone Bridge had the lowest number of snags. Pond Brook held the area that was most fitting for the expected result of snags in an unevenly aged forest. Two of Pole Bridge measurements for snags per acre are within healthy ranges for Northeastern Hardwood forests. However, they are not at healthy levels at Pole Bridge.

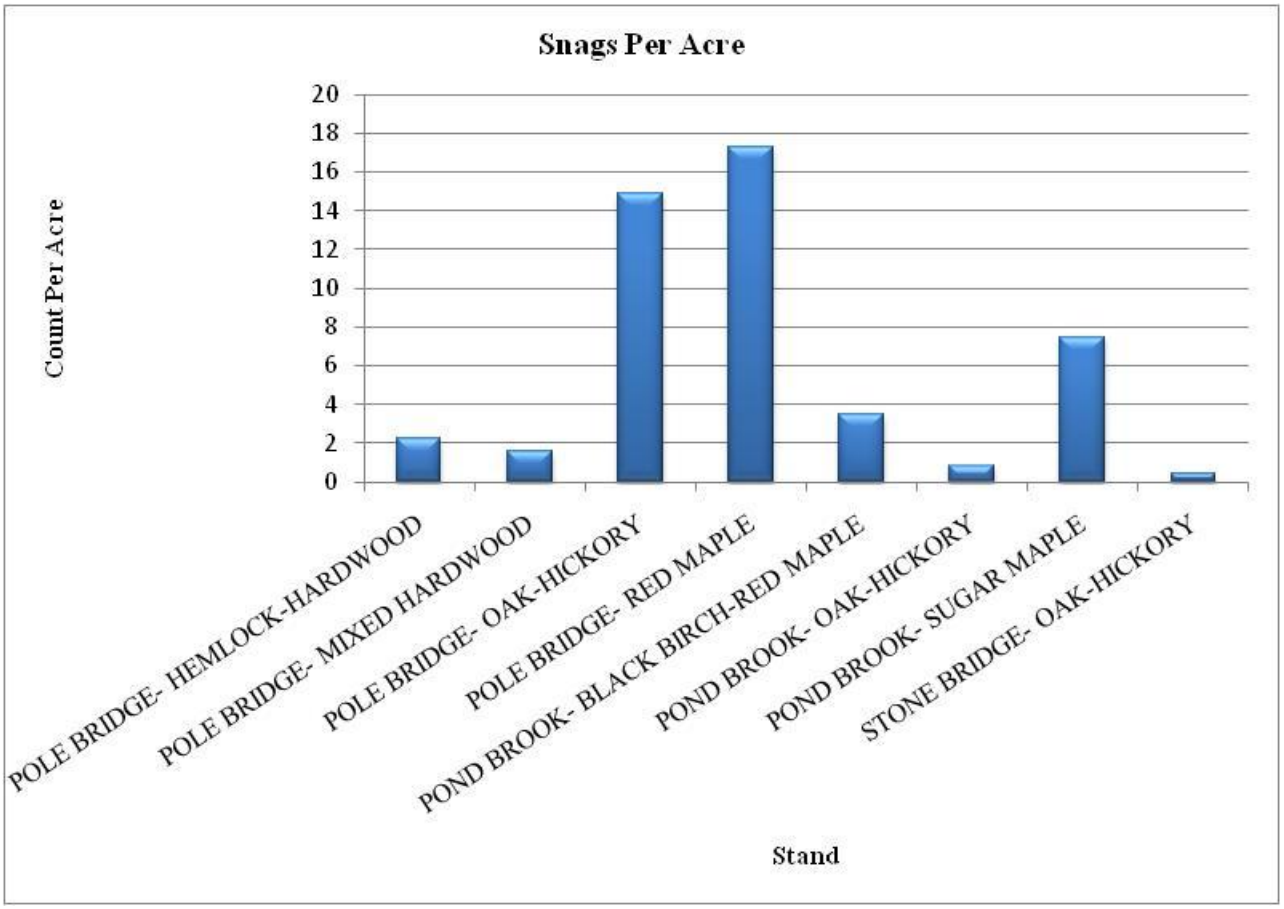

Figure 22: Snags per acre across all stands

These forests are in transition between unevenly aged and a maturing forest. Wildlife habitat is necessary for the control of insects by woodpeckers and for nesting sites of owls and neotropical migratory birds. Diversity in forest composition allows for the breakup of the cover type not only for aesthetics but also for light availability.

Typically stands with more standing dead wood are those that are in mid succession and whose tree composition is relatively short lived. Species in this category are red maple that readily succumbs to heart rot and is not long lived. Typically hardwood stands that are relatively disease free have the least amount of standing dead wood. A common occurrence for standing dead wood is the attack of insects and fungi. However, stochastic events such as lighting and storms can also damage trees beyond their ability to fight off disease or demand more photosynthate than the leaves can produce. The Red Maple stand at Pole Bridge has the most standing dead wood and the least standing dead wood was at Pole Bridge Red Maple Stand. This is fitting with the common elements of stand maturation and the tree's ability to withstand disease.

Snags are caused by fungi and insects that have attacked formerly living trees and damaged them beyond their ability to defend themselves physiologically. They were unable to withstand the damage and have succumbed to death. These trees have an important role in wildlife diversity. These trees harbor insects that feed on wood and overwinter in the standing dead wood. They offer food for woodpeckers and other birds that feed on insects throughout the winter and into the photosynthetic months of the summer. These trees also offer habitat in the form of cavities. These cavities are able to offer owls, flying squirrels and other cavity preferring species suitable nesting and hibernation locations. This habitat is made available by woodpeckers and by the decomposition of wood in the standing dead wood.

Coarse Woody Debris (CWD)

Coarse woody debris is important in the dynamics of the forest ecosystem. Coarse woody debris is crucial for many ecological functions: as habitat for organisms, in energy flow and nutrient cycling, and by influencing soil and sediment transport and storage of surface runoff (Hamon et al). Carbon is being released from downed coarse woody debris and along with nitrogen are limiting nutrients in forest ecosystems. They support amphibian and reptile life processes. Providing a suitable location for foraging for insects by larger mammals, downed dead wood resides on the forest floor and has fallen from snags or branches that have been abscised. Downed woody debris measurement methodology can be found in chapter (1). Expected for an unevenly aged stand is approximately 1000 cubic feet per acre of coarse woody debris on the forest floor (McGee et al). All sites came in below the mean for the study by McGee et al. This would indicate a lack of wildlife habitat and a disruption in the nutrient cycling. Logging in the area has meant the removal of some nutrients that are not fixed from the atmosphere. Nitrogen is removed from the system by logging. Most likely logging has been the culprit of the lack of CWD in the stands.

Living trees are converted to standing dead wood and logs. Logs and branches on the forest floor are categorized as coarse woody debris. Snags and logs are transformed to soil, humus and organic matter. Respiration conducted by fungi breaks down the coarse woody debris into finer

pieces eventually washing away in export through water erosion or they become part of the soil. Once part of the soil and broken down sufficiently the nutrients are made available to plants that use the nutrients in metabolic processes. The weathering of organic material and the breakdown of organic material by fungi and bacteria make the nutrients available to plants again. Fungi have relationships with plants that can be antagonistic in the case of diseases or beneficial in the case of symbiotic fungi. Fungal elements called mycelium pervade the upper levels of soil on the forest floor. These decomposers break down plant and animal material returning it to trees that fix the recovered carbon.

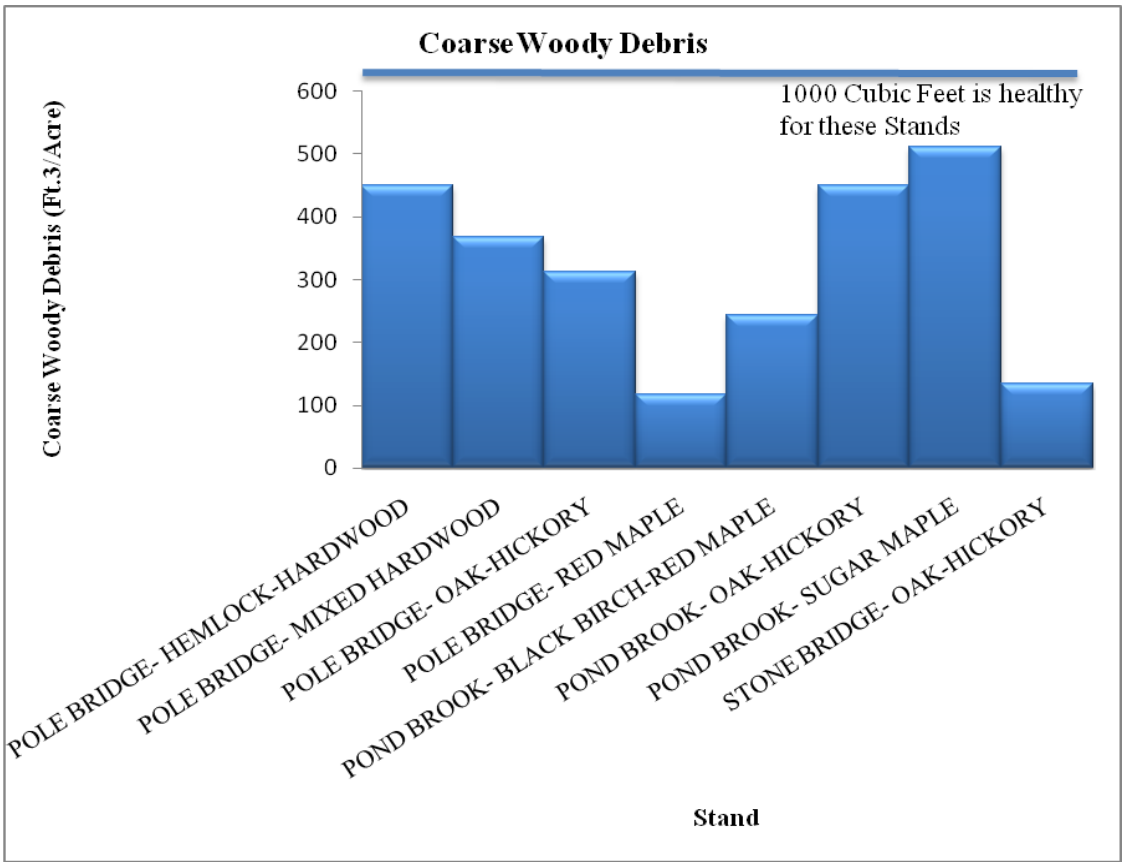

Figure 23: Shows coarse woody debris. Since wildlife use these fallen logs for homes and food sources more coarse woody debris can increase the carrying capacity of the land.

Wildlife

Past vegetation at these properties included species that are not present today including the American chestnut. Because the chestnut blight eradicated the American chestnut, many species existing on the hard mast of this species are not present today. Furthermore, the hard mast that this species produced was a major component of the nutrients for the wildlife of the region. The forest was changed again during the heavy logging during the late 1800s. At this point many agricultural areas were placed on the landscape. Edge habitat became the dominant ecotone on the landscape and species that prefer hedgerows were prevalent. Among edge preferring species were turkey, ring-necked pheasant and other game birds. As agricultural areas became populated

with eastern red cedar, old field junipers and wolf trees a different contingent of wildlife became dominant. Deer who prefer edge and eastern red cedar became more numerous. Wolf trees at the edges of meadows and agricultural land fostered habitat for birds of prey and were a seed source for the trees that would one day populate the agricultural lands that were returning to the forested condition. Over time land returned to the forested condition and it went through several phases.

During stand initiation many saplings are populated in the meadow that is returning to the state of being forested. This is prime habitat for ruffed grouse and rodents that are prey for raptors, coyotes, and fox. Furthermore, this is a stage where both black berry and raspberry will be fruiting and wet mast from these plants will be prevalent in the landscape. Stem exclusion is the competition for light, in this phase canopies will be developing. This provides habitat for squirrels, caterpillars and hence butterflies and other canopy dwelling species. Hard mast will also become available to wildlife. Hard mast includes acorns, hickory nuts, and American beech nutlets. This hard mast is good for squirrels. Deer will eat some hard mast and so will turkeys. These nuts are heavily laden with carbohydrates some of which will leech into the soil and become food for soil born organisms; others will be consumed by organisms in higher trophic levels. Understory re-initiation is indicated by strata of trees in the understory becoming more prevalent by forest gaps occurring through canopy trees. This understory, composed of hardwood trees provides habitat for neotropical birds and allows for unevenly aged trees to compose the forest over story. Old growth forest has mainly hard mast. This forest has cavities in trees and has an open understory with not much herbaceous cover.

Figure 24: This garter snake was found at Pond Brook where it preys on small mammals, insects and other reptiles.

The current state of the forests across all properties is stem exclusion. We are finding wildlife indicative of such a stand including grey squirrel, species of neotropical and boreal birds as well as resident birds. Since habitats are fundamentally the same, the species list across all three properties is the same as the species list for the Upper Paugussett Forest. Reptiles and amphibians, birds, mammals and plants are in the same biophysical space as upper Paugussett and hence it can be inferred that these species exist at these properties. Species that are found on these properties may not be confined to these properties. They may den, nest and reside on these properties; however, they may feed and drink elsewhere or *visa versa*. A combination of hard

mast and soft mast exist at each site. Invasive species provide food. Berries and drupes are common on invasive species. However, this low quality food is not high in nutrient value and while the birds eat their fill, they are not able to migrate long distances with the nutrients gathered from invasive species. While the phase of the forest is currently in stem exclusion it will migrate to understory reinitiation.

The future of the forest is understory reinitiation and then old growth. In the future a higher diversity of wildlife will be evident at the properties. Understory reinitiation will allow more species to inhabit the forest due to more stratification in the forest. Vegetative diversity will make way for animal diversity. Greater stratification results in more neotropical birds, a different light regime and more herbaceous cover. More herbaceous cover will allow for more deer to be present. The carrying capacity of the land will also increase. More mature stands will show a higher level of snags and more cavities. More cavities provide homes for predatory birds and squirrels. Hard mast will become dominant and species that feed on hard mast will become more prevalent. In the case of the future forest we will see a higher diversity and a species richness that is greater than the forests of the past. However, given the time necessary for these changes to take place it is unlikely that the forests will contain this richness for another 100 years plus.

Pole Bridge

In the mixed hardwood stand at Pole Bridge coyote and fox scat were found. These two species are omnivores and function as scavengers in the ecosystem. These organisms are widely dispersed in this region and are indicators that there is enough plant and animal material in the ecosystem to support the population. Carrion, living rodents, domestic cats and plant vegetative structures are consumed by coyotes and foxes. Two unidentified hawks were seen at the site. Rodents such as rabbits, mice, voles and other birds are prey for hawks. The presence of hawks indicates the presence of nesting sites. A skunk was detected through its remnant odor on one visit and it is widely known that skunks are a favorite food item for the great horned owl. The site is well within the range of the great horned owl and most likely supports a population of these birds. However, the population of great horned owls or other raptors at the site is not known. Birds were plentiful at the site including cavity dwellers and nesters. Birds included black-capped chickadee, cardinal, tufted tit mouse, coopers hawk and northern flicker. Brown creeper, dark-eyed junco and American crow were seen. Of decomposers and insects considered to be diseases we found blue-cheese polypore, the artists conk, and hemlock scale. No wooly adelgid was found on the hemlocks. However, this northern slope is cold and moist. With the below preferable temperature the adelgid is likely to inhabit warmer areas. If adelgid does become established, it is likely the hemlocks will withstand the pest as moisture from the soil will replace dehydrated needles fed on by the insect. There is evidence of white-footed mice at the site where we found a bone with chewings on it. For mice, the only source of calcium in the forest is that of bones left over animals and from deer antler sheds.

The Hemlock-Hardwood stand at Pole Bridge is a vegetatively sensitive area. The soils are thin and the trees are on a northern facing slope. This area is relatively cooler year round. However, in the winter this hemlock stand provides a thermal blanket available to wildlife. During winter snow storms these branches will hold snow. The forest floor may also be covered with snow.

This creates a still air space that between the two layers. Deer will use this area as a thermal blanket. They will use these areas during the winter as areas that are warmer than the surrounding forest where colder temperatures persist. Wind is prevalent in these outlying hardwood stands. While mast is available on the forest floor wind, cold and precipitation are present and are not amiable for deer during long winter nights and cold days.
Concerning the cut stump treatment in combination with the brush hog, this piece of equipment is not available on the market. It is possible to manufacture a piece of equipment such as this; however one does not exist for sale by a major manufacturer. This piece of equipment, as conceptualized, is a brush hog with a sprayer attached to the top of it. There is a tank that holds the pesticide, a small gas engine to power the sprayer and spray nozzles on the back of the brush hog facing the ground. The nozzles are active as the mower passes over the affected area. In this way the exposed stumps are treated with herbicide, although not highly targeted this method may be effective in dense areas of infestation. Employing this method during leaf senescence is most effective.

Stone Bridge

Stone Bridge wildlife was sparse. This may be due to the lack of stratification in age classes of the trees. However some observations can be made. A pileated woodpecker was found at this site; it is a keystone species. This species provides cavities for other birds that are cavity nesters and dwellers that do not have the ability to make cavities themselves; birds in this category include owls, animals include flying squirrel. Sassafras and spice bush were found here. These species are butterfly food for several species including swallowtails. A burrow was found on the site that is most likely from a wood chuck. Deer scat was present. A hawk nest was also on site. Deer at this site were prevalent as indicated by repeated scat observation. At the time of observation the scat was composed mainly of vegetative material. This fresh green material shows us that they were grazing on highly nutritious leaves. There is a browse line present at Stone Bridge and the population of deer could be inhibiting forest regeneration.

Pond Brook

This area included a variety of wildlife from birds to snakes. Black-capped chickadee, cardinal, blue jay, northern flicker, and white-throated sparrow were present. Among wood warblers, Blackburnian warbler was noticed. Turkey vulture and hairy woodpecker were also noted on the property. Chipmunk inhabited the stone wall area in the central portion of the area. Coyote scat, deer rubs and a game trial were noted on the property. This property was the most diverse and included a meadow of prime importance for many species preferring edge and available seed and cover. This area provides nesting area and overwintering grounds for sparrows in search of seeds. This area also provides deer browse. Here there is access to water at pond brook and there is available food for herbivores and omnivores thus supporting primary and secondary consumers.

G. FOREST HEALTH

Overview

Forest health can be measured by the presence or absence of species and the diversity of species that the forest supports. This area is a habitat for birds, particularly of neotropical migrants that nest in Connecticut. The properties have shown a variety of habitats, mostly influenced by man that has varying degrees of impact. As the cultural landscape has evolved the usage of the land was determined by commerce and the needs of the people living on the land. Charcoaling, timber harvesting, pasture and stochastic events have played a role in species diversity. Primarily, the impacts have been severe in the case of land clearing for pasture or farmland, loss of nutrients from that usage then a return of species that were present prior to such events. However, due to disease such as Dutch elm disease and chestnut blight no management practices to date have been able to bring back the forests of the past. Some attributes of forest health are the available species, the available physical conditions to include available nutrients and site condition. Given such conditions some sites reflect a healthier ecosystem than others.

Pole Bridge

Pole bridge is traversed by a Right of Way that has introduced an edge and fragmented the landscape. Animals no longer have cover to move between forested tracts. This site contains invasives that have come in from adjacent lands. The Hemlock-Hardwood stand is valuable as these hemlock groves are becoming less prevalent in Connecticut and this northern facing slope will limit the adelgid in the stand due to the cooler temperatures and the available moisture at the site. The mixed hardwood stand at the most elevated section of the forest contains habitat for wildlife and supports a diversity of understory plants. Lichens are an indicator of forest health and at this site none were noticed. This is most likely due to the nearness of the site to Interstate 84. Increased levels of pollutants can cause forest health problems for lichens due to the sensitivity of the lichens to atmospheric pollutants. Also, the noise level from the adjacent highway was in excess of 80 Db approximately 30 m from the interstate. This amount of noise inhibits calling birds from communicating with one another. Noise can cause disruption in bird mating, territoriality, and parental location by chicks.

Stone Bridge

Figure 25: Box Turtle found at Stone Bridge

This stand is made-up of a variety of hardwood tree species. It lacks stratification which can limit bird species. However, the availability of nutrients is abundant. The soil structure contains a profile that is amiable for most tree species of the area. It also contains a wetland and access to water for wildlife. There is little food for deer. In turn, deer will move to food that is newly sprouted. This can incur damage to plants, inhibiting them from reaching maturity and setting seed for subsequent generations. Deer browse on seedlings and saplings can also limit the amount of photosynthetic tissue substantially shortening the life of the young plant. Lichens were present at this site. Adjacent to the property are more contiguous sections of land that makeup a larger area supporting wildlife characteristic of large tracts. The landscape is also fragmented by a pipeline and this limits cover for animals wanting to move between forest tracts. The health of this forest was the best of the parcels surveyed and its priority for management should be considered when making decisions.

Pond Brook

Pond brook shows a variety of habitat. Like other sites it has had a cleared section of land that once fragmented the landscape. That area is now meadow and contains brush piles, young Black Birches and taller grasses and native shrubs such as blackberry and raspberry. These characteristics allow wildlife to remain concealed as they move between forest covers. Furthermore, while the stream at Pond Brook tests consistently lower in water quality than other sites, it does contain invertebrates and drinking water for wildlife. The Red Maple stand at Pond Brook has downed junipers in it signifying a changed landscape from pasture. There are also remnant pasture plants present. As the landscape is shaped from early successional habitat to more mature hardwoods a changed wildlife contingent will be present. The availability of cavities, the presence of birds and the availability of deer browse and evident rubs show that this area is a relatively healthy parcel and should be given priority in management decisions.

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V. SOCIAL ASSESSMENT

A. OVERVIEW OF SOCIAL CONTEXT

Newtown faces rapid population and development growth. Between 1990 and 2000, the town's population increased 20.5% to exceed 25,000 residents, making Newtown one of the fastest growing towns in Connecticut. While the economic recession slowed development in recent years, previous decades of development, especially in the northern and eastern areas of town, have noticeably impacted the community infrastructure and systems. Housing development has risen steadily over the past 50 years, with larger individual house lots. As population and economic growth continues to drive development, Newtown strives to attain a balance, enjoying the benefits of growth while maintaining and protecting its key local natural resources and improving passive recreation opportunities for its residents (2004 Plan of Conservation and Development).

B. METHODS FOR SOCIAL ASSESSMENT

In our efforts to provide recommendations to the town for managing their properties in a manner consistent with their objectives, we developed a rapid social appraisal to identify how natural resources are used, to assess stakeholders' perspectives, and to identify how decisions regarding the properties are made, implemented, and enforced.

We used multiple methods in our rapid appraisal to see how individuals and groups use and value the properties as well as participate in decision processes.

Observations

We made observations through several means. First, in our visits to each of the properties over the fall and winter, we observed signs of recent use and encroachment; these included, for example, children's toys, hunting stands, beer cans, and evidence of firearm use. We also noted historical uses, represented by old stone walls, antiquated signage on the properties, forked trees indicating regrowth from stumps, and the mixing of the top soil layers that often indicates plowing. Finally, we made observations when conducting interviews, gaining insights into contextual factors and behavioral patterns of participants.

Interviews

We conducted semi-structured interviews with key individual residents (our methodology for selecting them is described below). Typically, one to two members of our group conducted each interview, some of which were held in person, others of which were held over the phone. In our

initial correspondence, we explained the goals and nature of our work. All members of the management plans group had a list of questions that guided but did not restrict discussions with participants. Upon completing interviews, we reviewed and fact-checked transcripts and then analyzed the social data in a social matrix.

To ground ourselves in several issues surrounding the management of these properties, we spoke with several specialists, including the Town Historian, several biologists, an epidemiologist, and forest managers. We also spoke with community members and sector representatives interested in and/or affected by the use and management of these and other of the town's open space properties, including neighbors, fishermen, hunters, walkers, cyclists, and horseback riders. Finally, we spoke to members of the Conservation Commission and several other town agencies and committees.

Using a snowball effect, we asked interviewees at the end of our discussion if there were other key stakeholders or user groups to contact, expanding the breadth of our conversations. Certainly, there are other individuals and organizations with valid interests and experiences that we did not contact; however, we began to hear similar concerns and suggestions from interviewees, suggesting a fairly comprehensive set of data. To organize and analyze this data, we developed a map of the social process, identifying participants (individuals, groups, organizations), their perspectives (e.g. expectations and demands), influence over the decision-making process (control and authority), and areas of conflict.

Historical and Archival Profiles

In speaking with the Town Historian and searching through old newspaper articles, town commission meeting minutes, several books at the C.H. Booth Library, and other archival information (e.g. government records, land deeds), we developed a historical narrative and grounded ourselves in the social context of these properties.

C. Stakeholder Analysis and Value Priorities

As described in our methodology, we spoke to an array of individuals with various interests in how the properties should be managed and for whom. Here we identify several of the key participants interested in and/or affected by the use and management of these properties. These properties mean different things to different people. For some, a property might represent a place where they can take their grandchildren for a stroll; get exercise by going for a bike ride; or spot migrating birds heading south from the Arctic. And still for others, the places transcend time to tell stories of what used to be – of historic and pre-historic times – and surpass their own physical boundaries to play important roles in their respective watersheds and contiguous landscapes.

While their interests and goals varied, most interviewees tended to focus their attention on trails. For some, they want few trails added and express concerns about potential impacts of trails on habitat and water quality. Others ask that current trails be maintained and that new and connected trails be added. It is important to note, however, that not all trails are compatible. For instance, it would be dangerous to have an interpretive signage along a mountain bike trail. Our social assessment suggests that finding ways to create trails that balance the safety and diverse interests of users with ecological objectives poses one of the greatest challenges in managing these properties.

Above: A tree at Pond Brook memorialized

Conservation Commission

The Conservation Commission represents a group of seven Newtown citizens with a common interest in conserving the natural resources of Newtown. They have different professional backgrounds, from medicine, oceanography and geology, to environmental engineering and administration for a pharmaceutical company. Of the Conservation Commission's five stated objectives for managing the open spaces, some individuals appear to orient more towards some of these objectives than others. One commissioner, for example, expressed concerns about the increasing disconnect between young people and nature; as a result, he or she was concerned especially with the environmental education component. Others seemed especially concerned with maintaining healthy and diverse woodlands. These individuals tended to focus on issues like invasive species control. This is not to say that these interests were mutually exclusive. Rather, individuals seemed to gravitate towards or orient around some objectives more than others. All, however, support protecting open spaces for passive forms of recreation. Other concerns include the unlawful removal of Conservation Commission Open Space signs from town property, lack of public use of and awareness about some properties, encroachments in the form of active recreation (e.g. ATV use), high levels of Lyme disease, erosion, and loss of farmland and wildlife habitat.

Land Use Agency

The Land Use Agency consists of the Planning and Zoning Commission, Zoning Board of Appeals, Inland Wetlands Commission, and Conservation Commission and works with other agencies and commissions in a variety of capacities. Staff process applications and permits and provide information to the public and others officials and agencies in the town government. The town's most recent Plan of Conservation and Development, prepared in 2004 for the Agency's Planning and Zoning Commission, includes a vision statement (page 10) to guide the town:

> The goal of the Town of Newtown is to protect and enhance its picturesque, rural, historic New England setting and attributes. The architecture and landscaping of all types of properties will be designed to protect the image of a rural and historic town. Over the next ten years various town agencies will work in concert to maintain a suitable variety of homes for its citizens taking into account varying lifestyles and economic capabilities while providing and developing equal recreational activities and facilities for everyone. We will work together as a town to promote and protect open space, farmland and trails throughout the town always maintaining an environmentally active position protecting our aquifers, wetlands and other ecologically sensitive areas. Education for Newtown's children will continue to excel in quality and efficiency. Newtown will succeed in attracting commercial businesses at a rate equal to its growth and the design of the town's roads and traffic patterns will enhance business development while minimizing traffic congestion for the residents.

Parks and Recreation – Trails Subcommittee

The Parks and Recreation Committee is composed of seven members dedicated to managing, supervising, and developing recreation programs for parks and other areas set aside for recreational purposes. Recently, a Trails Subcommittee was created to develop a strategic plan and system of interconnected multi-purpose trails. They have held workshops and developed several proposals for developing trails. While the Trails Subcommittee seeks to develop plans that support a variety of uses, some user groups expressed tacit concerns about the impact of these trails on wildlife, wildlife habitat, and the people that value wildlife.

Newtown Forest Association

As the oldest private land trust in the state and owning approximately 1000 acres of open space, the Newtown Forest Association represents a key landowner and neighbor of town open space properties. They have overlapping goals with the Conservation Commission, including protecting special places and making them accessible to the community. However, there does not appear to be a formal public-private partnership, which the 2004 Newtown Plan of Conservation and Development identified as a key target for "maximiz[ing] available resources toward the goal of protecting open space in a manner that promotes orderly development." One of the NFA's properties has a high abundance of invasive species along its border with a Newtown open space property, providing a tractable opportunity for collaboration.

Neighbors

Neighbors to open space properties can play varying roles and have different interests. Some are protective of and vested in open spaces, wanting them and their inhabitants untouched. Some are purportedly the ones that encroach, and some want the town to go away and let things go back to the way they used to be. Their use of open spaces includes bird watching, hiking, dog walking, fishing, and/or relaxing on the properties. Of those that we spoke to, future development seemed to be one of the most prominent concerns. Some have witnessed a variety of encroachments, including littering, unlawful fires, and illegal timber cutting and poaching. Due to such

encroachments, some are concerned about additional trails on Newtown's properties that would increase access to and around their backyards.

Hunters

Today, hunting is largely a leisure activity focused predominantly around deer and pheasant hunting. While some hunters appear to have an interest in using town open space for hunting, others seem to consider it a hassle to try and change Newtown's prohibition on hunting on town lands and seek hunting opportunities in other, less-developed places, such as state forests or land leased for hunting. Several other stakeholder groups expressed concerns about hunting, due to actual or perceived risks to personal and pet safety and ethical arguments against all or certain types of hunting. Evidence of hunting in open space properties that explicitly prohibit this form of land use may exacerbate these concerns.

Fishermen

Newtown offers trout and bass fishing in several streams, rivers, ponds, and lakes. Private organizations like the Newtown Fish & Game Club and public agencies like the Department of Environmental Protection stock Newtown waters with brown, brook, and rainbow trout. Fishermen in Newtown value the lands and waters that sustain places to fish and are concerned with impacts of development on water quality and stream flow. Other stakeholders do not seem to have any particularly strong opinions of fishermen. Walkers, for example, will notice them while walking along Pond Brook but not be particularly distracted by or deprived from this form of recreation.

Walkers and Hikers

Walkers and hikers appear to be one of the dominant users of town open space. Selection of destinations for walking tend to be shaped by a number of characteristics, including the availability of convenient parking, user-friendly trails, scenic views, healthy forests, bird life, streams, shorefronts and lake fronts, waterfalls, and places of historical interest. Some are concerned with other forms of recreation (e.g. mountain biking, ATV use, and hunting) that might degrade the landscape and/or directly conflict with their experience.

Mountain Bikers

Mountain bikers seek trails that are compatible and safe for cycling. They believe there is plenty of space for such trails and that, when done right, these trails will not have adverse impacts on the landscape. Some cyclists perceive Newtown as a potential cycling hub in the tri-state area, due to space on the roads, multiple state parks, and state land. They see cycling as a healthy pursuit and form of transportation for all ages. Mountain biking is scrutinized by other stakeholders for environmental reasons including potential for erosion and degradation of

wetlands and other habitats; purported use of motorized dirt bikes that may follow providing access to mountain bikes; and concerns that this form of recreation is counter to the intent and purpose of open space.

Horse Back Riders

As a historically agrarian community that has attracted regional vacationers, Newtown has had a long history of horseback riding, including a dude ranch that offered rodeos, pony riding, and western shows in the 1950s. The Newtown Bridle Lands Association, formed in 1988, seeks to foster an interest in horseback riding as well as preserving, protecting and maintaining riding and hiking trails in the community. Horseback riders seek trails that are horse-friendly, especially bridges that can accommodate horses. Some expressed safety concerns about hunting that occurs on lands adjacent to town open space property where they ride. Others are concerned about the loss and degradation of historical trails by development and adequate parking for trailers.

Cross-Country Skiers

Cross country skiers and snowshoers appear to use several of the properties. We were unable to speak to any individuals or organizations; however, much like fishing, skiing and snowshoeing in open space properties appeared to be non-controversial forms of recreation that were seldom brought to the forefront by other interviewees. This may stem, in part, from the fact that skiers and snowshoers use the properties at a time of the year when other user groups do not.

D. RESOURCE ISSUES

We identified "resource issues" as activities, conditions, or situations that impinged on our clients' main priorities for the properties, including forest health and invasive species, wildlife, environmental education, recreation and trails, and deer and ticks. These resource issues were identified using methods of observation in the field as well as through our interviews with stakeholders and user groups. In many cases, these methods reinforced each other. However, in other instances, our interviews revealed additional resource issues. For instance, one neighbor informed us that water levels in Pond Brook had been dropping over the past few decades, while another alerted us to the fact the Lower Block of Paugussett State Forest lacks access. We have listed the resource issues identified while walking the properties and from discussions with community members in Table 1.

Many of these issues, like an isolated presence of invasive species or a lack of signage, may be addressed by the Conservation Commission alone. However, several of these issues stem from a mosaic of ownerships and land uses across space and time. Working with neighbors, user groups, and other local and state public entities will be necessary to address inter-property cases of invasive species encroachment, town concerns about Lyme and other tick-borne diseases, and regional road and trail access issues.

Pond Brook	• few tree seedlings/little advanced regeneration • invasives such as Japanese barberry • infestation of Ailanthus in the meadow • lack of access from road • very limited parking along Pond Brook and Obtuse Roads • only one trail, along former railroad grade, which would be difficult to extend • observed litter and purported poaching , illegal fires, and removal of trees • anecdotal evidence of stream levels being lower than historic ones • unsightly tennis court • invasives on neighbors' land act as a seed source • Lyme disease
Pole Bridge	• noise from Interstate 84 • few tree seedlings/little advanced regeneration • sign along Pole Bridge covered by trees • large patch of Japanese barberry and other invasives like Phragmites • invasives on neighbors' land act as a seed source • illegal hunting • bittersweet in the red maple stand • erosion of main access trail • old, falling down chicken building may be dangerous and create liability • Lyme disease
Stone Bridge	• a high proportion of edges and early successional habitat creates habitats for invasives • rutting of utility access road causing some erosion • lack of sign along Highway 34 • few tree seedlings/little advanced regeneration • evidence of illegal hunting • multiflora rose at north side • phragmites encroaching on wetland • Lyme disease

Table 1: Resource Issues by Property

VI. RECOMMENDATIONS

To aid the Conservation Commission, the Planning and Zoning Commission, the Selectmen and staff in various town offices, we suggest three planning horizons in these steps: a near term (the next year, mid-term (2-4 yrs) and long-term (5-10 yrs). Importantly, these planning horizons reflect our assessment of both the time and cost of implementing our recommendations, with easier and less expensive steps in the near- and mid-term and more involved and costly steps in the long-term. We included charts of our overall recommendations as well as charts of our recommendations for specific properties as Appendices G and H. In addition, we included a chart of the steps we recommend that Newtown take to implement our recommendation.

A. OVERARCHING ISSUES—APPLYING TO ALL PROPERTIES

Forest Health and Wildlife

All three properties pose issues with invasive species, some of which can be managed within the given property by the town government alone. Other invasive encroachments occur across easement and property boundaries. Finding ways to foster meaningful collaborations with neighboring land trusts, residents, and easement owners will be important for managing several invasive plant species.

We recommend preserving the wolf trees found at all the properties because of their cultural and biological importance. Since their wide crowns were formed without shading from other trees, wolf trees reflect a time when the landscape was open and probably planted to crops. Wolf trees also provide large seed sources to their respective stands and, with their gnarly limbs and common cavities, significant sources of wildlife habitat.

Environmental Education and Recreation and Trails

Apply for a Community Grant from Iroquois Gas Pipeline LP, which provides local governments with up to $15K for Environmental Education and Passive Recreation. Communities affected by Iroquois pipelines are eligible for the grants, which could partially pay for the environmental education and passive recreational development recommended in this plan.

Recreation and Trails

Beyond those living close to the properties, few in Newtown seem to know of them or use them. Indeed, in our many visits this fall, we saw very few people hiking, walking, biking or otherwise enjoying these public spaces. But many user groups identified trails as their highest priority for

the properties. Because the Conservation Commission wants to increase public use of Newtown's open space properties, we recommend publicizing the properties in new and more effective ways. In the short term, we recommend making existing road signs more visible and erecting road signs on properties that do not have any now. In the medium term, as trails are improved and environmental and historical interpretation is added, the trails should be publicized on Newtown's website and in its many promotional and informational materials.

Deer and Ticks

Cases of *Lyme borreliosis* in the United States are on the rise in the United States. In 2005, the Center for Disease Control and Prevention cited nearly 24,000 reported cases (Piesman and Eisen, 2007). Despite a robust literature and advances in the scientific and medical communities, determining the drivers of disease risk in natural systems has proven incredibly difficult. The transference of Lyme disease occurs through "complex webs of interactions involving numerous species on multiple scales, influenced by abiotic conditions and the vagaries of human behavior, placing them among the most difficult systems in community ecology" (LoGiudice et al., 2008). Climate, soils, and the population dynamics of the spirochete (the causative agent of the disease), tick vectors, and vertebrate hosts all influence the distribution of the zoonotic disease over space and time.

The current debate in Newtown and many other towns in Connecticut facing high rates of Lyme disease, property damage from deer browsing, and deer-car accidents places the spotlight on culling and hunting deer. While there is a distinction in these two forms of management (in terms of methods, intents, and actors involved), both these forms of deer management seem to be distilled by many into the question of to shoot, or not to shoot. Deer, while not a competent reservoir for Lyme disease spirochetes, do provide an important food source for adult ticks. Efforts to manage tick-borne diseases with deer culling and removal have had mixed results: while total elimination of deer has resulted in significant decreases in tick populations and cases of Lyme disease, partial reductions have had varied and often indiscernible impacts (e.g. Clark et al. 2008).

The acrimony surrounding deer and ticks is fueled by the politicization of science, concerns about human-wildlife conflict, and disparate views on and understandings of "the problem" of management. Given this complexity and the many variables at play in the dispersal of the zoonotic diseases, there are many management options. These range from avoiding areas with high-tick abundance, to taking protective measures with one's backyard, body, and pets, to targeting the disease, its vector, and the vector's many hosts, and altering the environment with prescribed burns and removal of leaf litter. Stakeholders may have different responses to certain treatments (e.g. disinclination to alter landscaping practices, concerns about pesticides and culling deer). Some treatments are especially expensive, demanding of labor, and likely to be ineffective at reducing cases of Lyme and other tick-borne diseases.

Tick-borne diseases are transferred amidst complex webs of biological, abiotic, and social interactions. In addition to raising awareness about protective measures and medical risks and

treatments, fostering understanding about the disease and its transmission may focus attention on other variables to manage.

Community concerns about Lyme and other tick-borne diseases may warrant integrating this knowledge into land use planning and open space acquisition programs to decrease exposure to zoonotic diseases.

B. POND BROOK

Forest Health and Invasives

Issue 1: Many stands lack regeneration and ground-story diversity. Several of these stands at the Pond Brook Property are in stem-exclusion, characterized by intense competition, dense canopies, and high mortality rates. With this intense competition and self-thinning for space and light in the canopy, few seedlings and saplings are able to grow.

Management options: A number of options exist for facilitating regeneration and ground story diversity, including opening up the canopy of some stands with heavy crown thinning or carrying out shelterwood regeneration cuts. These and other options modify the light regime to promote regeneration, stimulate seed production of residuals, and may select for certain phenotypic traits, species, or aesthetic values. Another, less intensive option is the creation of snags, or standing dead trees. In creating snags, one opens up small isolated gaps, allowing light to reach the understory around the base of the dead tree. These management options have a number of advantages and disadvantages. Regeneration cuts may lead to increases in bird diversity, development of vigorous ground story, and creation of greater vertical structure for wildlife. The Pond Brook property offers an example of a dramatic clearing where the previous owner cleared an entire section of the forest, which has since evolved into a meadow. Additional forest clearings on this property require permits because of necessary stream crossing to access the property. Crossing the stream with large machinery will increase sedimentation and erosion, imposing adverse effects on the brook's water quality. Creating snags with girdling techniques will provide additional wildlife habitat and open up a small amount of the canopy, but likely not enough to allow invasives to become prevalent[13]. However, leaving standing dead trees could be seen as a safety hazard if done close to trails.

With no road access for heavy machinery and with the potential negative effects of opening up the canopy on both the forest and brook, we recommend selective girdling of trees, especially red maples that will provide high wildlife habitat quality.

- Short term: girdle according to wildlife habitat needs in particular stands; ask Newtown Forest Association to control large barberry patches on their property
- Medium term: leave snags alone and monitor for invasives in small gaps created; if needed, work with NFA to control invasives on the property border
- Long term: monitor girdled trees for safety hazard trees and cut any hazardous trees.

[13] For guidelines on snags see USDA Forest Service http://www.fs.fed.us/eng/php/library_card.php?p_num=9924%202809

Issue 2: One tree of heaven (*Ailanthus altissima*) was found in the early-successional meadow that was created by the developer's clear cut. It is a fast-growing, invasive tree and prolific seeder (NPS website, accessed Dec 2010) that can take over sites with dense thickets and produce chemicals that prevent the establishment of other plant species.
Management options: A number of options exist for managing trees of heaven, including biological, manual, mechanical, and chemical methods. Repeated cutting of the root system will exhaust the root system, while single cuts may actually result in larger numbers of sprouts and root suckers. Herbicides may be applied to prevent re-sprouting; while herbicides are typically cheaper than continued labor, some stakeholders may be opposed to the use of chemicals.

We recommend a combination of chemical and mechanical methods, with the cutting of individuals and application of herbicides to cut stems.

- Short term: Cut and spray individuals currently present on the sites
- Medium term: Additional cutting and spraying of sprouts may be needed. Check if new individuals have established and treat them accordingly.
- Long term: Monitor stand edges and clearing for new tree of heaven establishment

Wildlife

Issue 1: Sand from roads degrades fish habitat by filling in streambed and decreasing its structure. A mix of substrate materials, ranging in size from cobble and rocks to pebbles and to sand, is one indicator of overall stream health. Diverse substrates provide more niches for aquatic insects as well as more favorable spawning habitat for fish. Ideally, less than 5% of stream bottom will have sediment deposited on it (Barbour, no date). Pond Brook is at risk from sedimentation because of its proximity to Pond Brook Road and the use of sand in the wintertime.

Management options: Reducing the amount of sand used along Pond Brook, or sweeping it up in the spring, are two options for protecting the substrate of Pond Brook.

We recommend both reducing use and sweeping sand on Pond Brook to improve stream conditions to increase the populations and vigor of native fish.

- Short term: recruit a stream steward who can monitor Pond Brook.
- Medium term: sweep roads along Pond Brook in the spring.
- Long term: increase fish stocks in Pond Brook.

Issue 2: The clearing made by the developer provides valuable meadow habitat for neo-tropical birds as well as overwintering boreal birds, but it will be lost as trees regrow there. Between development and the rapid re-colonization of old fields by trees, meadow-type lands in Connecticut are few and far between. As a result, habitat for ground-nesting birds is scarce. Though the previous owner cleared the trees to build a road for his planned housing development, the clearing is and will continue to provide important habitat for ground-nesting birds. It also is important as a source of food for overwintering boreal birds, such as the chickadee.

Management options: The meadow could be maintained either with mowing or burning. While burning may be more effective against invasive forbs, and would encourage the growth of warm-season grasses, which can withstand fire and are an important component of meadows and prairies, the long, narrow shape of the meadow is ill-suited to burning.

Therefore, instead of burning, we recommend mowing to maintain openness in the landscape, and preferably every year, in the late winter, i.e., prior to April 15th or the last frost.

Environmental Education and Recreation and Trails

Issue 1: With no bridge across Pond Brook, there is currently no public access to the property.

Management options: Building a footbridge or car bridge, or securing access to it (either by confirming the existence of trail easements with neighboring property owners whose lands are crossed by the railroad grade or by negotiating new trail easements), and/or buying the neighboring properties that have the railroad running across them.

There may be pedestrian and bridle easement access to the Pond Brook and Newtown Forest Association property currently available from Currituck and the end of Adams Hill Lane. We recommend that deed research be done to confirm that these easements exist. If not, we recommend that Newtown try to buy a property along either Currituck or George's Hill Road that has the railroad running across it, and trying to secure easements to the railroad track in between the properties. Because the Newtown Forest Association has a similar "land-locked" property neighboring Pond Brook in the direction of Currituck Road, it might be easier and cheaper to attain access by buying and/or getting conservation easements toward Currituck Road. Alternatively, one of the three property owners between Pond Brook and George's Hill Road owns a significant section of the railroad grade; and the property owner between them and Pond Brook has a conservation easement and so might be inclined to provide trail access through an easement. Assuming access can be secured, we recommend in the short term that volunteerism and stewardship be encouraged at properties. In the medium term, we recommend installing interpretative signage. And in the long term, we recommend developing environmental education for all town lands.

Issue 2: Pond Brook has a wealth of cultural, historical and natural resources, including probable Indian usage and artifacts, the old dam/mill site, and the unusual hardwood-hemlock stand, that can be interpreted for the community.

Management Options: Picnicking spots and a "pocket park" with a playground, or picnicking spots and a new kind of playground called a "natural playscape" that uses natural elements, like logs and boulders, for children to play on and with.

In addition to erecting interpretive signage and providing information via cell phone about the site's cultural and natural resources, we recommend a natural playscape. Instead of a traditional and common playground, we feel a natural playscape would be more in keeping with the natural

character of the site. It also is a new kind of development that would reflect Newtown's progressive orientation.

Issue 3. Old tennis court and fence. A previous owner built a tennis court on the property, located upstream of the old bridge. The court still has an approximately ten foot-high chain link fence around it.

Management Options. Removing the tennis court and fence. The tennis court isn't in keeping with the nature of the playscape we recommend or the historical era of the interpretive elements.

However, because the tennis court itself is neither obtrusive nor dangerous, we don't recommend removing it immediately. Rather, it could be removed when and if the playscape, trail and interpretive facilities are developed. We do recommend quickly removing the chain link fence, which could pose a risk if children were to climb it, and could be removed cut and rolled until a bridge is built or other property access is otherwise secured.

Recreation and Trails

Issue: Despite the fact that five historic railroad lines run through Newtown, few if any hiking or biking rail-trails currently exist in Newtown.

Management options: Let other communities develop trails, or actively pursue development of a rail trail on one of Newtown's five railroad lines, including the New York, New Haven and Harford railroad line.

We recommend that Newtown actively pursue the development of the NY, NH & H Railroad line. In the short term, we recommend involving the Trails subcommittee in assessing the development of a rail-trail at Pond Brook and including it in the 5-year strategic plan they are developing. If they need help assessing the benefits and challenges of developing a rail trail, they should reach out to the Rails-to-Trails Conservancy to get advice about the process of developing a rail trail, and also should contact neighboring towns with rail-trails to see where they plan to develop future trails.

Deer and Ticks

Issue 1: The open space of Pond Brook provides habitat for ticks and their hosts. Given the complexity, level of concern in Newtown about Lyme and other tick-borne diseases, and relevance to this property, we recommend raising awareness about risks and the community ecology in which Lyme disease exists and targeting white-tail deer with a four-poster device, which has proven effective in several locations (Sonenshine et al. 2006, Carroll et al. 2003, Pound et al. 2000a, 2000b, Solberg et al. 2003). Deer whose ears are coated with mild insecticide from the device can act as vacuums, essentially sucking up and killing significant numbers of ticks (pers. communication, Dr. Durland Fish, Epidemiologist, Yale School of Public Health). As prescribed above, mowing the meadow at Pond Brook will target invasives and foster wildlife

habitat. While this meadow is not prime tick habitat, mowing will reduce the invasive species like Japanese barberry, which do encroach into forest interiors where they harbor ticks.

- Short term: Clarify what conditions there are for using 4-poster; work with Tick-Borne Disease Committee and Parks and Rec to develop this adaptive program; locate 4-poster device in accessible sites where deer are prevalent.
- Medium term: Site locations for 4-poster devices
- Long term: Monitor and adapt practices accordingly

C. STONE BRIDGE

Forest Health and Invasives

Issue 1: There is a lack of regeneration and ground-story diversity at Stone Bridge. Much like the stand conditions at Pond Brook, Stone Bridge has a lack of regeneration and ground story diversity. Unlike Pond Brook, edges are especially prevalent in this property. Formed by trails, the gas pipeline, and Paugussett State Forest, these edges represent an opportunity for more invasives should the canopy be opened up substantially.

To limit invasive establishment and proliferation in forest interior and to prevent large increase in edge habitat, we recommend selective girdling of trees, especially red maples that will provide high wildlife habitat quality.

- Short term: girdle according to wildlife habitat needs; ask Iroquois Gas Transmission System, L.P. to control the invasives on their easement to help prevent invasive establishment where the canopy is opened up.
- Medium term: leave snags alone and monitor for invasives in small gaps created; if needed, continue to ask Iroquois to control invasives on their properties
- Long term: monitor girdled trees for safety hazard trees and cut any hazardous trees. Once invasives are minimized then re-consider costs and benefits of doing a shelterwood treatment.

Issue 2: The Iroquois Gas Transmission Systems, LP easement acts as a corridor for invasive plants. Presently the gas easement acts as a corridor for the dispersal of invasive species. The company has committed to mowing its right-of-ways every three years but does not appear to have protocols for controlling invasive species on easements beyond this regimen. We recommend working with the gas company to increase frequency of mowing the easement; preferably, the mowing would be done yearly.

Wildlife

Issue: A shortage of den trees constrains habitat for mammals and birds. Mammals, including raccoons, squirrels, and birds, including owls, use cavities in trees for nesting.

We recommend preserving the wolf trees found at all the properties because of their cultural and biological importance. Since their wide crowns were formed without shading from other trees, wolf trees reflect a time when the landscape was open and probably planted with crops. Wolf

trees also provide large seed sources to their respective stands and, with their gnarly limbs and common cavities, significant sources of wildlife habitat.

We recommend girdling trees according to the guidelines provided by the Forest Guild for the Northeastern United States where they recommend having a minimum of five snags larger than ten inches in dbh (diameter at breast height) per acre (Forest Guild 2010). The size of a snag is extremely important, as a small birch pole could never hold large birds or mammals, whereas large snags can be used by small and larger birds, rodents, and mammals. Therefore it is important to select large trees (at least ten inches in diameter) for snag creation to maximize their utility. Also, large snags tend to last longer than small snags so it is more effective to focus on large snags. Height is not as important as girth but it is wise to choose taller trees as most animals prefer to be high, likely to increase their distance from ground predators (Hunter 1990). Since there are differences in decay rates of trees species and in the degree of wildlife use, it is advised to select a variety of tree species for snag creation (Forest Guild 2010). For more information on how to create snags, please see the following US Forest Service document (Windell 1999): http://www.fs.fed.us/eng/pubs/pdfpubs/pdf99242809/pdf99242809pt01.pdf

Environmental Education

Issue: The property is well-suited for environmental education by school groups.

While we do not recommend development of new trails, we do recommend the development, potentially by collaborating teachers, of an environmental education curriculum for Stone Bridge that would be used by K-6th graders along with scouts and other community groups. Stone Bridge has enough open forest to allow students to move around unobstructed.

In the medium term, after the curriculum is developed, parking should be improved (see Recreation and trails recommendation below) to better facilitate school groups attending for environmental education through schools.

Recreation and Trails

Issue: Few people use existing trails Stone Bridge, and there is a lack of a clear, established access to Lower Block of Paugussett State Forest.

Management options: Continue to let Stone Bridge be used by a few as an entrance, or establish a more formal and more clearly marked entrance to the Lower Block of Paugussett State Forest.

We recommend developing Stone Bridge as an official access point to the Lower Block of Paugussett State Forest.

- Short term: check with state officials about their interest in developing Stone Bridge as an access point, and also with the Connecticut Forest and Parks Association, which maintains a Blue-Blazed Trail, the so-called "Zoar Trail," on the Lower Block.

- Medium term: erect a road sign and improve the parking area; trail signs should also be added showing the way to the Lower Block of Paugussett.

Deer and Ticks

Stone Bridge provides another opportunity for using the four-poster device. As fewer people seem to use this property than the Pond Brook property, and as there are few residences in the vicinity, we would suggest that the Pole Bridge site be prioritized over the Stone Bridge site. We recommend that a sign be placed at the parking lot and trail head to raise awareness about protective measures, risk of exposure, and the community ecology of Lyme and other tick-borne diseases.

D. POLE BRIDGE

Forest Health and Invasives

Issue 1: As with the other two properties, much of Pole Bridge is in stem exclusion, characterized by intense competition, dense canopies, and high mortality rates. With this intense competition and self-thinning for space and light in the canopy, few saplings are able to grow. A number of management options, as outlined above, exist to increase regeneration. However, to access these stands, managers would have to cross the steep sloped and sensitive Hemlock-Hardwood stand. Such disturbance could affect this stand negatively, with high soil erosion and increased presence of pests such as elongate hemlock scale.

To limit invasive establishment and proliferation in forest interior and to prevent large harvesting machinery use that might damage ecologically sensitive areas, we propose a selective girdling to create snags.

- Short term: girdle according to wildlife habitat needs in particular stands; ask Iroquois Gas Transmission System, L.P. to control the invasives on their easement to help prevent invasive establishment where the canopy is opened up.
- Medium term: leave snags alone and monitor for invasives in small gaps created; if needed, continue to ask gas company to control invasives on their easement
- Long term: monitor girdled trees for safety hazard trees and cut any hazardous trees.

Issue 2: The Pole Bridge property has a sensitive Hemlock-Hardwood stand, vulnerable to Elongate Hemlock Scale, potential wooly adelgid infestation, and drought induced by climate change. A number of options exist to protect the stand, including preserving the stand by salvage harvesting the declining hemlock or leaving the stand alone and monitoring for declines in stand health (reduced crown vigor; presence of scale and/or adelgid). More intense management efforts could reduce severity of outbreak, prolong the presence of the hemlock stand, and remove safety hazard of dying trees falling onto trails. However, harvesting will increase erosion and could negatively impact vigor of residual trees via abrasion during tree felling. More hands-off approaches allow the stand to respond on its own and prevent needless tree removal efforts and

costs. However, if the insects increase in population quickly it may be too late to respond at a later date and a large component of the hemlocks will be lost.

Since the stand is generally healthy and the site is conducive to hemlock growth, the stand has a high chance of surviving future insect outbreaks and drought events. As such, we recommend that the stand be left alone and monitored for declines in vigor and appearance of wooly adelgid. If adelgid appears at any time, harvest and removal of any infected trees should occur as soon as possible.

- Short term: Leave alone and monitor. Any wooly adelgid infected trees should be removed as soon as possible.
- Medium term: Leave alone and monitor. Any wooly adelgid infected trees should be removed as soon as possible.
- Long term: Continue to monitor and if hemlocks begin to decline severely due to hemlock scale then consider salvage harvesting senescing individuals that pose a safety hazard. Any wooly adelgid infected trees should be removed as soon as possible.

Issue 3: A substantial patch of Japanese barberry exists in the mixed hardwood stand on the Pole Bridge Property and several properties pose additional seed sources. While a number of methods exist, with tradeoffs in terms of time, costs, and effectiveness, we recommend a combination of mechanical and chemical treatments.

- Short term: This patch should be cut with a brush mower once per growing season in early fall, followed by a cut-stump herbicide once a year until the root systems stop producing shoots. Also, ask Iroquois Gas Transmission System, LP to control invasives on their easements and ask Newtown Forest Association to work together to control the barberry patches on their property that are encroaching town land.
- Medium term: Repeat short-term treatment and continue to monitor neighboring properties and gas pipeline easement for increases in invasive populations and continue to ask for property owner's help with control.
- Long term: same as previous steps.

Issue 4: Asiatic bittersweet is strangling early successional trees on the edge of a red maple stand. With high reproductive rates and long-range seed dispersal, bittersweet can disperse quickly, with adverse impacts on a variety of habitat types. Presently, bittersweet has been found to be encroaching on a red maple stand. Without restriction, it will likely move further into the stand, strangling trees along the way.

Management options: Options to control and eliminate the bittersweet typically occur as repeated cutting, either of climbing or trailing vines as close to the root collar as possible or just above the ground level. Asiatic bittersweet will re-sprout unless cut at a level of frequency that exhausts the root stock.

We recommend a combination of cutting and application of herbicides to prevent further tree mortality and encroachment in the stand.

- Short term: Cut or girdle climbing and trailing vines just above ground level in early fall. Paint undiluted triclopyr into the freshly cut surfaces of the stump. Repeated applications may be necessary to eliminate re-sprouting.
- Medium term: monitor and repeat treatment when needed
- Long term: monitor and repeat treatment when needed

Wildlife

Issue 1: Almost 80 decibels of car noise impairs the ability of certain birds, including owls, to communicate with each other. Communication between owls is essential for their breeding.

Management options: A living or wooden or concrete fence could be built.

We recommend assessing the political will for building a noise-barrier fence made either of trees or concrete/wood. By reducing the noise from the highway secondary benefits to predator-prey relationships including rodent management and biodiversity will be levied.

Noise Barrier for I84 at Pole Bridge:

A noise barrier along interstate 84 at the Pole Bridge site is likely to have little effect due to the geography of the landscape. The recommendation for a noise barrier is helpful. However, the geography of the area is such that the necessary height for the noise barrier is not feasible. As I84 lies in a valley and Pole Bridge has some elevation, any noise that comes from the interstate will over top the barrier and would impact the wildlife at the site. Any noise that was behind the barrier and at the angle with which the noise would be alleviated is relatively small. Furthermore, the canopy, where birds would congregate, would already lie within the area where noise would be unobstructed.

Currently there are seedling hemlocks at the interface between I84 and Pole Bridge. We recommend allowing these trees to persist and to develop seed for another generation. As these hemlock trees are evergreen and their density is persistent in winter and summer, these trees are performing noise reduction as they stand. Allowing these trees to persist will perform noise reduction on a scale that is feasible and within cost. These trees on the edge also disallow noise into the canopy of the trees on the interior. Although noise is present at Pole Bridge removing the vegetation present on the margin of I84 and Pole Bridge would increase the noise further. The best practice at this site is to encourage hemlock growth and allow that growth to persist.

Issue 2: Scattered corn indicates that hunters are baiting deer in the Iroquois right of way.

We recommend having the warden stop by to check.

Environmental Education

Issue: Kiosk needs information and maintenance.

We recommend installing information on the forest stands at Pole Bridge, especially the rare north-facing Hemlock dominated stand.

Recreation and Trails

Issue 1: Trail from Pole Bridge road is eroding seriously.

We recommend installing water bars to shunt water off trail and decrease erosion. In the short term, we recommend contacting a local Boy Scout troop to see if they are interested in a service project.

Issue 2: Existing road sign is obscured by trees.

We recommend cutting back trees to make the sign more visible.

Issue 3: Few people use the existing trail.

Management options. The trail could be expanded and made into a loop trail for either hikers or mountain bikers. For safety, the trail should not be intended for both hikers and mountain bikers.

We recommend building a mountain bike trail because Pole Bridge has enough slope and space to make a good mountain bike trail, and because other town and state lands are more oriented to hiking trails.

- Short term: reach out to the president of the Newtown mountain biking club, Terrance Ford (203-526-8247), who is eager to help build trails.
- Medium term: plan and build trail that includes these features: use the main access trail up from Pole Bridge Road, past the kiosk, through the oak-hickory stand to the Iroquois gas pipeline, loops back through the hemlock stand, goes through the ash pole stand, follows the stone wall by the large oak and maple wolf trees at the top of the hill of the hardwood stand, and avoids the stream in the mixed hardwood stand on the northeastern side of the property. See Appendix J for a map of the proposed bike trail.

Deer and Ticks

We recommend considering this property along with other open space priorities as a candidate for the four-poster device. During our field study, we noticed many deer tracks, rubs, scrapes, and droppings; additionally, one resident reported regular sittings of deer in the morning emerging from this property.

Control of barberry as previously outlined and control of noise (to improve habitat for noise-sensitive predators that feed on rodents) may also lead to additional controls on tick hosts and environment.

E. CONCLUDING THOUGHTS

This portfolio of recommendations encompasses an array of suggestions over several time scales. Of course, these recommendations will need to be assessed relative to other demands at other town properties given the town's financial, social, and other constraints.

Based on our assessment of the properties and their management needs, we submit that the following needs be given most immediate attention.

At Pond Brook, we believe the following issues warrant the highest priority:

- managing the meadow for wildlife value,
- preserving the historical and ecological value of the Brook's edge, and
- addressing issues of access

At Pole Bridge, we believe that the following issues warrant the highest priority:

- managing its several invasive species that currently present threats to forest health,
- monitoring its sensitive hemlock-hardwood stand requiring monitoring, and
- adding water bars to the eroding access trail

While habitat edges pose the risk of encroachment of invasive species at Stone Bridge, this property requires the least immediate attention.

As mentioned earlier, charts of both our recommendations and the steps to implement them can be found in Appendices G and H.

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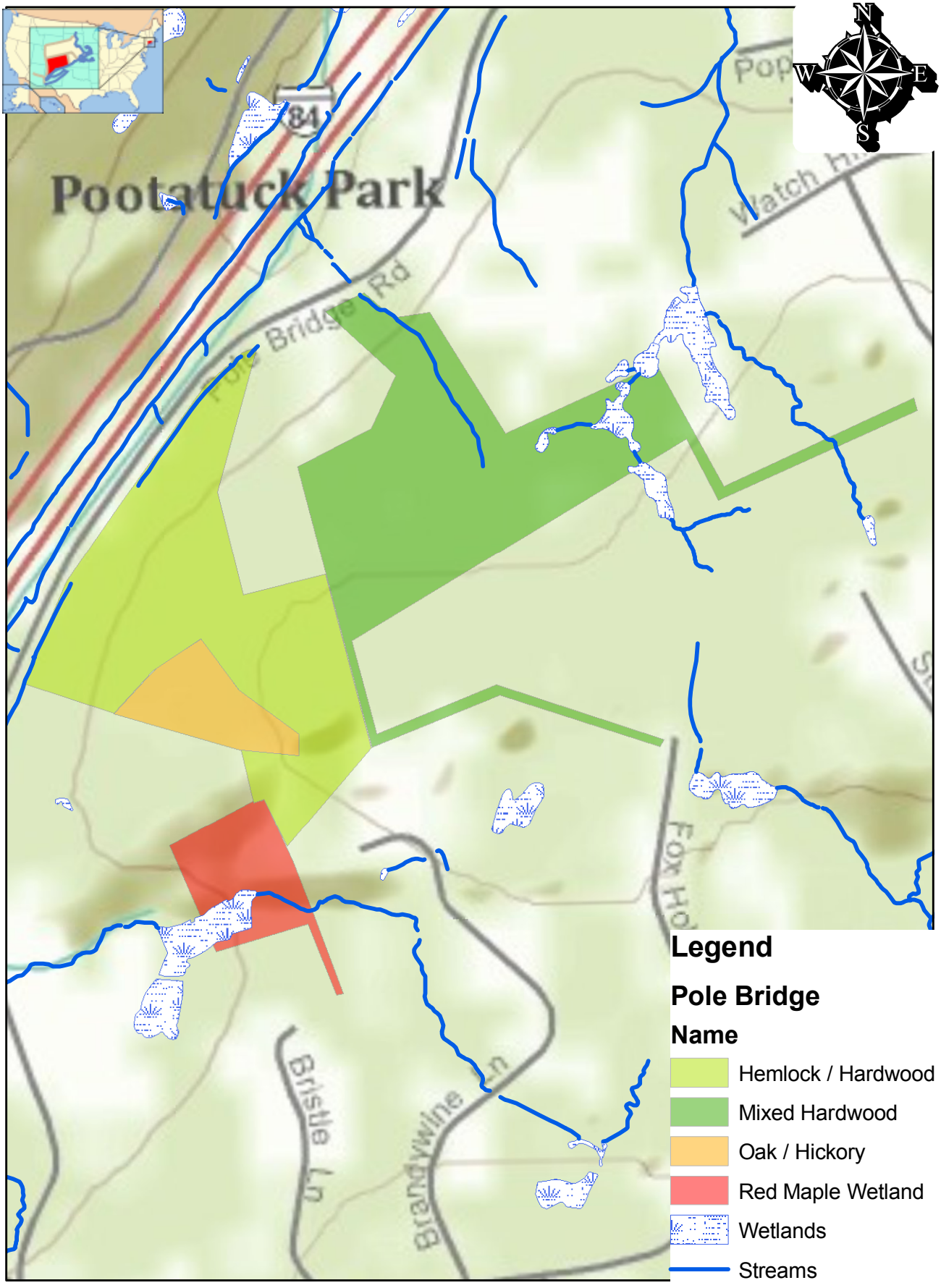
APPENDIX A: ROAD AND POLITICAL BOUNDARY MAPS BY PROPERTY

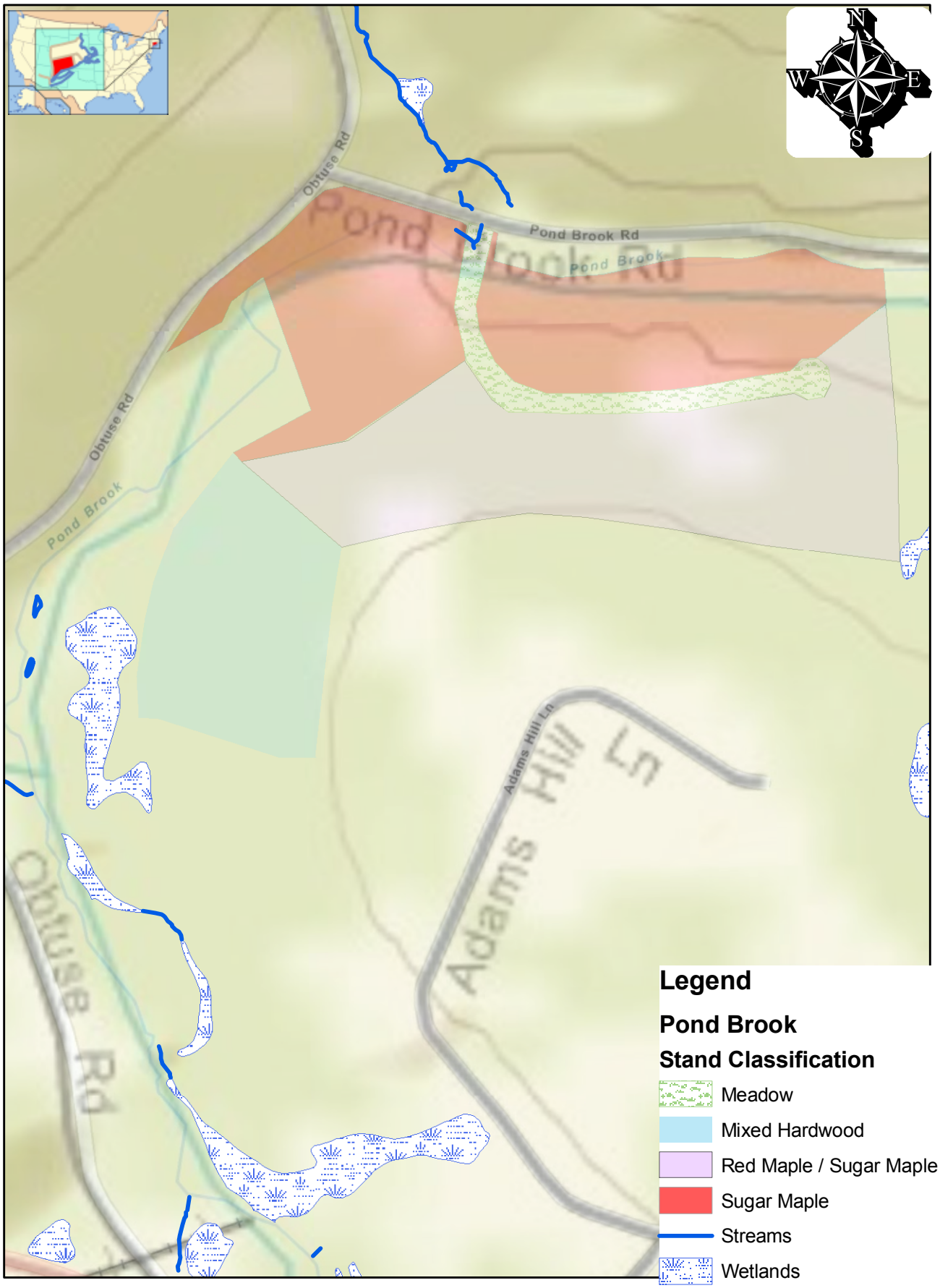
Pole Bridge Adjoining Features



0 255 510 1,020 Feet

Map Creator: Lucien A. Bouffard

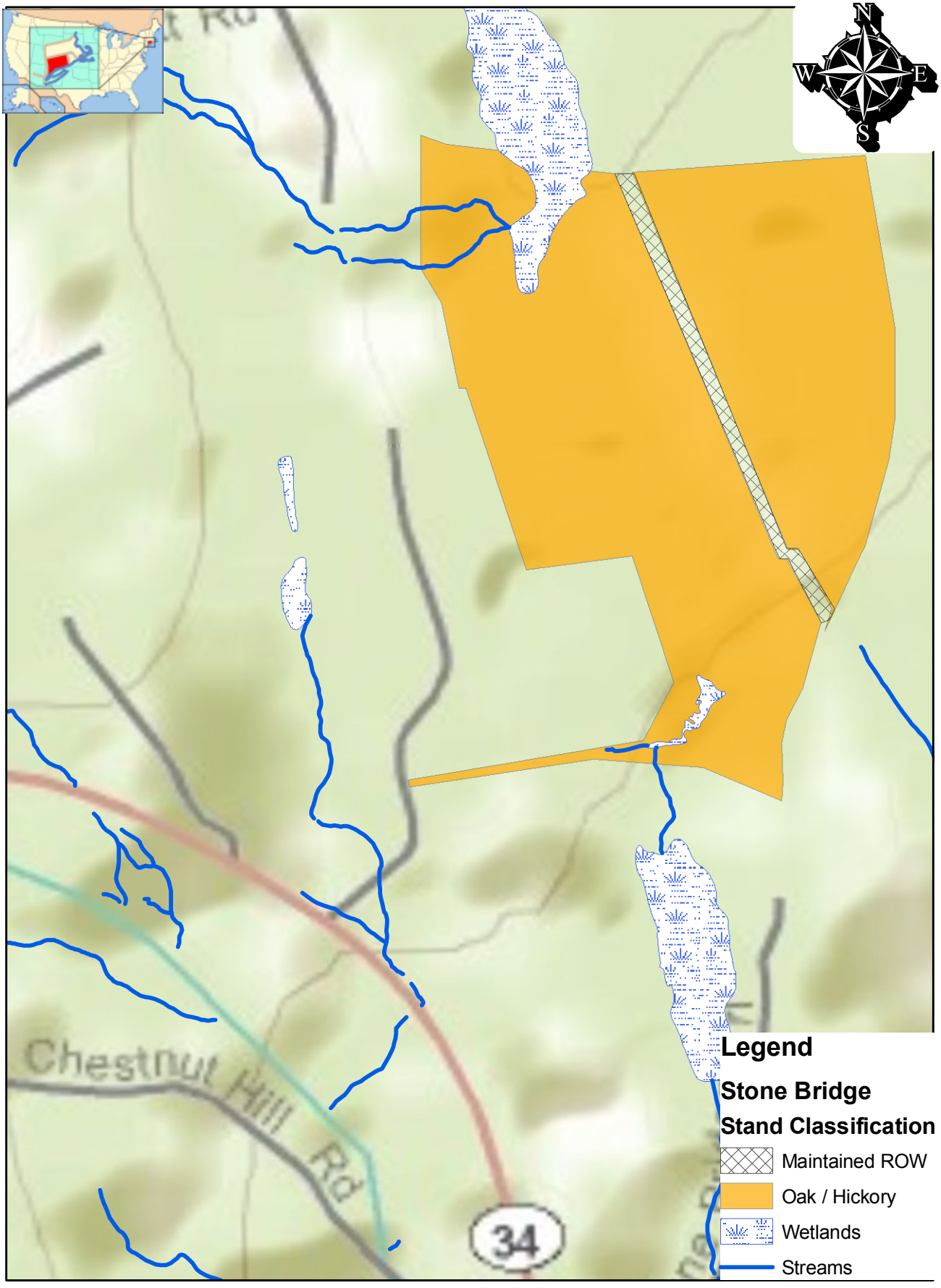
Pond Brook Adjoining Features



0 165 330 660 Feet

Map Creator: Lucien A. Bouffard

Stone Bridge Adjoining Features



0 185 370 740 Feet

Map Creator: Lucien A. Bouffard

APPENDIX B: SAMPLING METHODOLOGY

As taking a biophysical census is not feasible given the limitations of time and resources, a sampling design is used to estimate the condition of the three properties in a manner that minimizes bias and maximizes accuracy and precision. With two teams of two, we followed the sampling design below recording information with a data sheet template that can be found in this section.

A. QUANTITATIVE SAMPLING

Due to the presence of distinct stands within each of the properties, we employed a method referred to as stratified random sampling, which breaks each of the properties into different sub-units and calls for randomized samples in each of these subunits. Based on systematic analyses of soils, hydrology, geology, stand structure and composition at all three properties, we have identified 8 forested stands and 35 plots with a minimum of 4 plots per sampling unit. The 3 open stands are not conducive to the quantitative sampling methodology.
The plots were generated randomly within each sampling unit by superimposing a UTM grid map (30 m x 30 m) over the stands maps in GIS, assigning a number to each intersection on the grid that falls within our sampling units, and then using a random number generator to identify which plots we will sample.
At each plot the following measurements were taken:

i. ***Overstory variable plot radius***: using a BAF 10 factor, we counted the basal area in the plot, and measured diameter at breast height and identified the species of the trees counted. We also did an ocular estimate of canopy height with a Biltmore stick.
ii. ***Herbaceous cover***: we measured percent cover for herbaceous layer with a Biltmore stick-length radius around plot center, assigning species present to one of the following categories: <1%, <5%, <10%, <25%, <50%, <75%, <90%, <100%. Regeneration was measured by counting the number of seedlings and saplings within the same understory plot for each species present. Saplings were be characterized as individuals taller than 12".
iii. ***Snag inventory***: we measured the density of snags through point quarter sampling by locating and measuring the distance of the nearest snag to the plot center in each of four quadrants. A 250 threshold for identifying a snag was used, and any plot where a snag was not identified, a value of 250 feet was entered. This value equates to less than 0.5 snags per acre, and therefore our snags per acre results were rounded to the closest whole number to account for this imprecision.
iv. ***Coarse Woody Debris Line Intersect Sampling:*** we set up a line transect 66 feet long that extended NW from plot center (chosen randomly). We counted the number of pieces larger than or equal to 3 inches in diameter at the point where it intersects the line and that are greater than 3 feet in total length. We also measured the transect diameter and total length of the pieces that met the above criteria.

B. QUALITATIVE SAMPLING

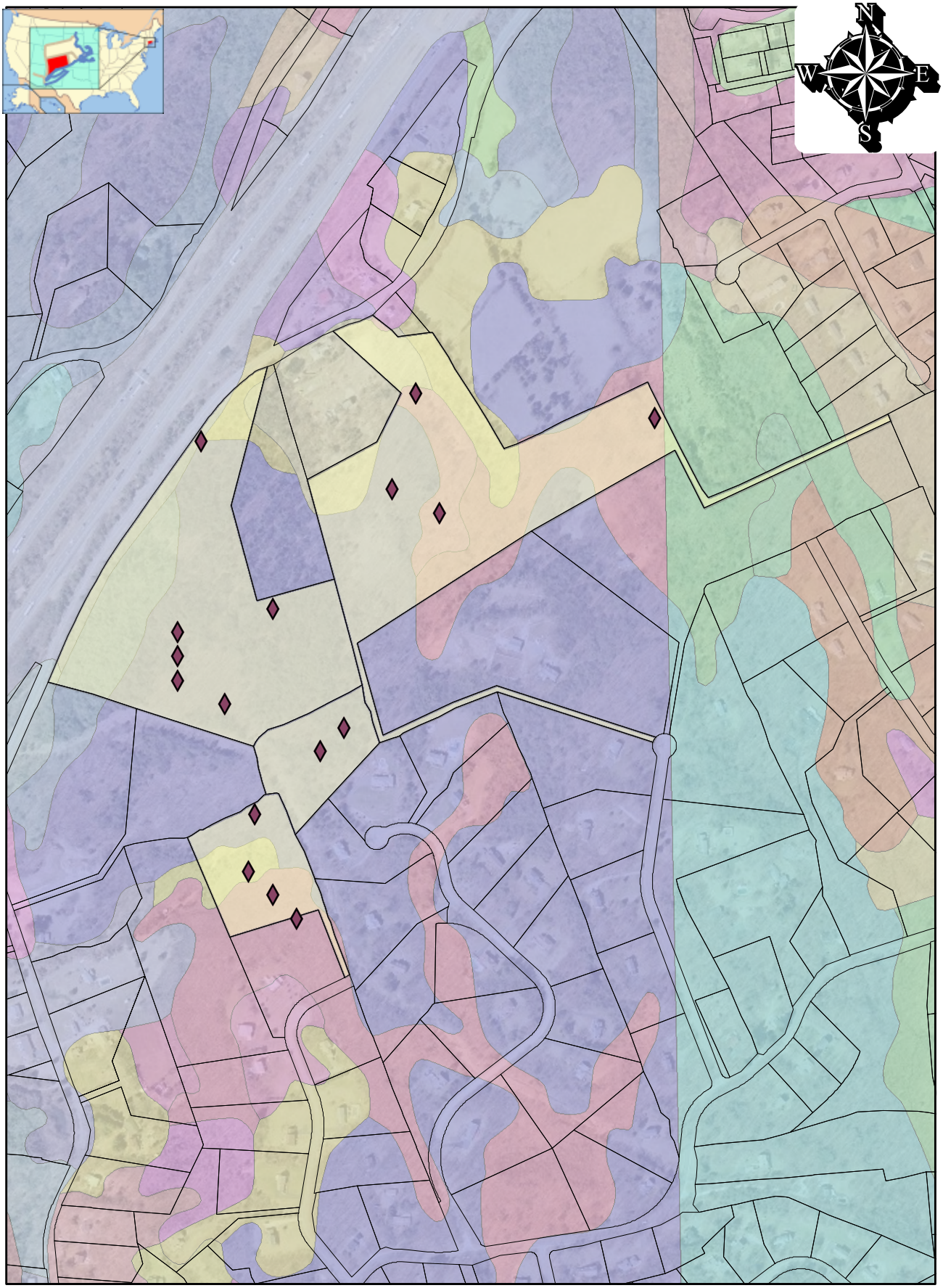
To further characterize the properties, we took qualitative notes in the following categories at every plot as well as very detailed notes in the 3 open units:

a. Tree species composition, size class, density
b. Indicator Species observed
c. Slope/Aspect
d. Stand Type/Phase
e. Stand Health: Crown vigor of individuals, presence of insects/diseases, degree of stratification (canopy through ground story)
f. Invasives: Presence, Abundance, Species Identification
g. Wildlife: individuals and scat observed, wildlife cavities, birds heard
h. Aesthetics: ideal sites for public trails
i. Cultural legacies: Presence of stone walls, wolf trees
j. Other: i.e., dumping, encroachments

These notes served as key components to characterize the sites as an entity. They were particularly helpful in describing the small diameter classes of tree species (less than 5 inches dbh) as the quantitative sampling employed did not suitably represent this size class. Plot location maps follow.

APPENDIX C: SAMPLING PLOTS AND DATA SHEET

Pole Bridge Sampling Point



0 275 550 1,100 Feet

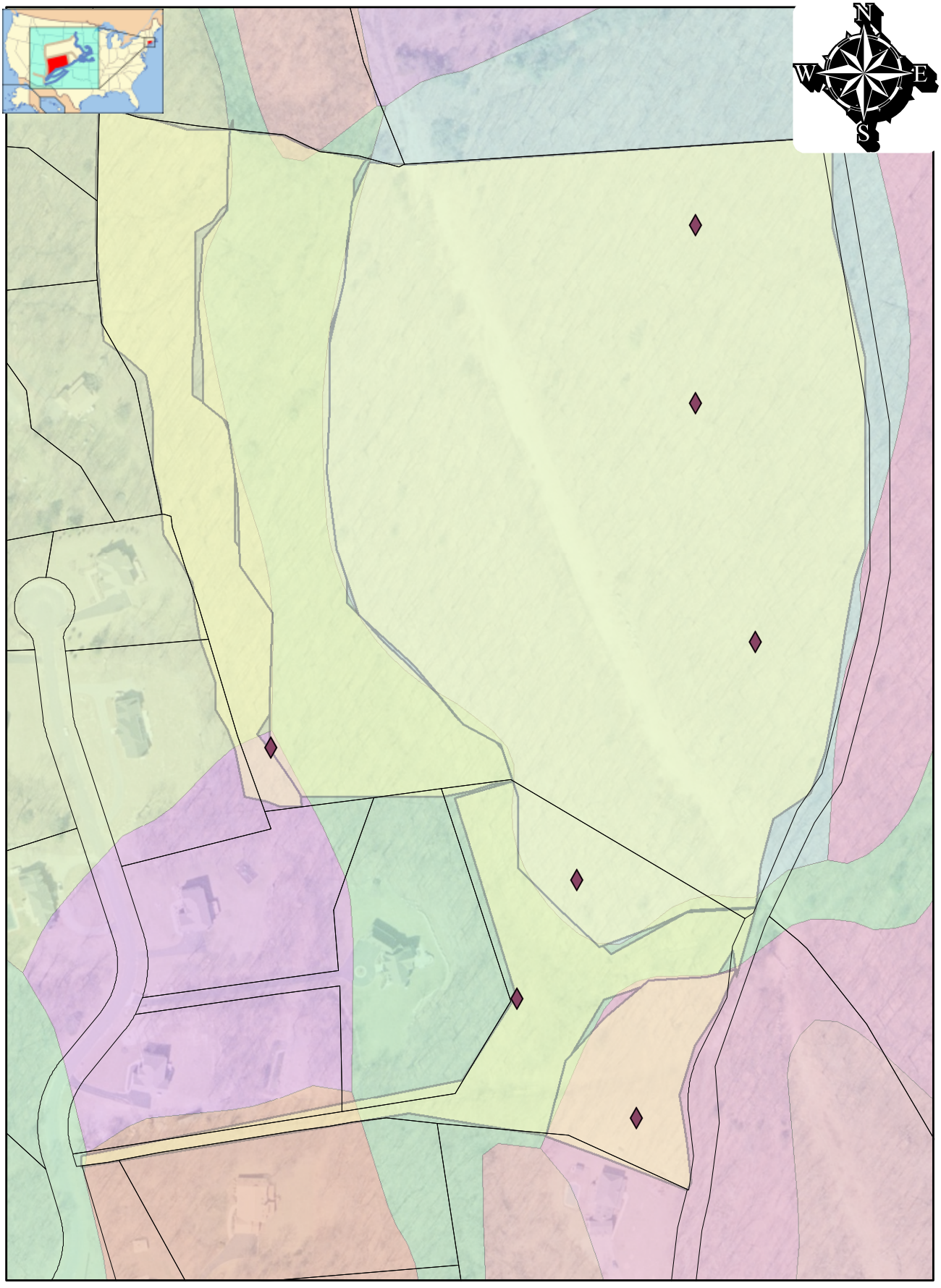
Map Creator: Lucien A. Bouffard

Pond Brook Sampling Point

0 170 340 680 Feet

Map Creator: Lucien A. Bouffard

Stone Bridge Sampling Point



0 110 220 440 Feet

Map Creator: Lucien A. Bouffard

Newtown Team Management Plan Data Sheet

Date: _____ Team Members: _____

Stand ID: _____ Stand Type: _____

Plot ID #: _____ Stand Development: SI SE UR OG

UTM Coordinates: _____ _____

OVERSTORY (BAF 10):

Species Code	DBH (inches)	Total Height (16 foot increments)	Notes	Species Code	DBH (inches)	Total Height (16 foot increments)	Notes

REGENERATION PLOT 1			UNDERSTORY PLOT 1	
Species	Seedlings	Saplings	Species	% Cover*

Note: Indicate seedlings (≤1ft in height) or saplings (>1ft in height, <4.5 feet in height)

***≤1%, ≤5, ≤10, ≤25, ≤50, ≤75, ≤90, ≤100**

WILDLIFE PLOTS				
Distance to Closest Snag (ft)	NW:	NE:	SW:	SE:
Number of pieces of CWD				
Dimensions of CWD-intersect diameter (inches) and total length (feet):				

Note: Record distance of closest snag from plot center in feet in all 4 quadrants.
CWD transects are 66 feet in length, extending NW (270 degrees) from plot center. CWD is defined as pieces larger than 3 inch in diameter and 3 feet in length.

APPENDIX D: SOIL PIT ANALYSES

A. Stone Bridge

Points 123, 124 and 125—Canton and Charlton Soils. These soils are found on the highest ground, the hilltops and ridgetops, and on 3-15% slopes. Extremely stony, these are very deep, well-drained, coarse loamy glacial tills. The soil profile has a 2 inch blackish brown O Horizon. The A Horizon is 4-9" deep silty sand, light brown in color, and well drained. Below 9", the sand is looser, has greater crumb structure, and has an orange cast.

Point 117—On the western edge of the parcel, the Woodbridge Fine Sandy Loam is found on gentle slopes (0-3%) but higher than the muck soils in the depressions. It is a moderately well drained, glacial till loam soil, with a few rocks. We found the first four inches of its profile to have brown- black organic layer, followed by about nine inches of sandy loam. Below 13", the soil is a light silty loam that is well drained.

Point 118—Paxton and Montauk fine sandy loam is a fine, sandy loam, glacial till soil. It is well-drained, on hills with slope 3-35%. It is very deep, with more than 80 inches to bedrock. It is similar in soil profile to Woodbridge, but with a lighter sandy loam from 4-15" down, and some gravel below 15".

Point 122—Catden and Freetown Soils are found in two depressions or wetlands on the site. One is located close to where the natural gas pipeline crosses the property's northern border. The other is in an ephemeral stream between the gas pipeline and the western border that drains into a permanent wetland. This soil is hydric, very poorly drained, formed from organic materials. We found its profile to be:

- O Horizon: 0-5" organic layer, brown- black organic
- A Horizon: 5-10" Clay, Grey brown, wet
- B Horizon: 10"- beyond: sandy brown, wet Soil Profile

Point 166—Ridgebury, Leicester and Whitman soils are extremely stony, with rocks on and below the surface, are poorly drained and are formed in loamy glacial till. The soil is mesic--quite moist, but not really hydric. It is mucky with clay and lots of organic matter but without saturation. We say no glaying.
We found its soil profile to be:

- O Horizon: a good inch, lots of organic matter
- A Horizon: dark, friable and wet (only able to get down 4 inches)
- B Horizon: Really mucky and rocky

B. Pole Bridge

Point 132—Hollis-Chatfield Rock Outcrop, 15-45 percent slope. Found on hilltops and on the steepest slopes, this is a well-drained and very stony soil. It is a coarser glacial till loam, and very rocky. We found its soil profile to be:

- O Horizon: 0-0.5” black brown
- A Horizon: 0.5-2”
- B Horizon: 2”- beyond: light fine sand

Point 131—Canton and Charlton, 3-15 slope. This is a well-drained, stony, coarse sandy soil formed in loamy glacial till. We found its soil profile to be:

- O Horizon: 0-0.5” organic layer, thin
- A Horizon: 0.5-5” light gray fine silty sand
- B Horizon 5-12”: sandy, lighter brown than 131, fine texture,
- Powdery

Point 163--Haven and Enfield Soils, 3-8 percent slope to the southwest. This is a well-drained soil that is formed in loamy mantle over stratified sand and gravel and that can be shallow to bedrock. We found its soil profile to be:

- O Horizon: very thin
- A Horizon: very good structure, crumb structure, a loamy soil, dark brown, fine silt and clay
- B Horizon: 7 inches down, lighter brownish, sandier soil with some clay
- Mesic, but moist (not saturated)
- No stones above or below

At the Ash pole stand, we found a soil type that isn’t on the soil map. Unlike the Hollis-Chatfield soils around it, this soil was free of rocks, had a dark O Horizon (about ½ inch thick) and had good crumb structure. Many worms castings were present, something not seen in Hollis-Chatfield, either. It had some clay, too.

Point 134—Sutton fine sandy loam, mostly flat or gently sloping to the northeast. This is a moderately well drained and stony soil.

Point 135—Ridgebury, Leicester and Whitman loam. This was not well drained but mostly free of stones. With its hardpan about seven inches down, and lack of an A-B Horizon, this soil may have been plowed. It is surrounded by double stone walls, which are usually thought to have been used to keep sheep in, but perhaps in this case, they were used to keep sheep out of land that was cropped, at least for a time. We found its soil profile to be:

- O Horizon: 0
- A Horizon: 0-3” mixture of sand and silt
- B Horizon: 3”- beyond: light sandy brown and silty

Point 137—Although not labeled on the Soil Conservation Service map, this wetland soil might Scarboro muck.

Point 165--Woodbridge fine sandy loam, with 8-15 percent slopes to the northeast. This is a moderately well drained, loamy and stony soil.

- O Horizon: Soils O- 1" Organic Black
- A Horizon: 8" Clayey loam fine sand. Clay silt, not a lot of sand, Cobble sized rocks. There are boulders on top of the earth. The soil is mesic to wet, aspect North 15-20 degrees

C. Pond Brook

Points 146 and 148 —Hollis-Chatfield has a steep gradient, with big boulders on top. We found its soil profile to be:

- O Horizon: Thin
- A Horizon: 7 inches thick, brown loam (silt, sand and clay – classic loam)
- B Horizon: Below 7 inches, sandier, lighter color, less structure
- More drained than previous sites

Point 149-- Charlton-Chatfield complex, 15-45 slope. This soil is well-drained and extremely stony. We found its soil profile to be:

- O Horizon: indistinct
- A Horizon: at least 8 inches, nicely textured, well drained loam, coffee/blackish, sand/clay/silt
- B Horizon: Below 8 inches – sandier and more rocky
- More rocks on the surface than WPT 148

Point 138—Ninigret and Tisbury. This soil had no distinct horizons, nor many rocks on top of the ground. It was very deep, very organic brown soil (no gravel or big chunks). It had really good structure, nice loam soil.
Point 140—Woodbridge fine sandy loam, located on steep slope. We found this soil profile to be:

- O Horizon: Thin (can't measure)
- A Horizon: 6 inches of a sandy, light brown layer with clay (san and clay)
- B Horizon: Below 6 inches, more organic, silty, finer grain, chocolaty brown

Point 142—Ridgebury, Leicester and Whitman is very rocky, with big boulders on top. It is a very dark, loamy soil. We found cinders next to a road, possible evidence of charcoaling. We found its soil profile to be:

- O Horizon is indistinct
- A Horizon: very dark, blackish, 7 inches, very good structure, light and airy

- B Horizon: Past 7 inches of A, there is a sandier layer with clay (sandier, clay with less organic matter)

Point 150—Paxton-Montauk, 3-15% slope, a well-drained, sandy loam soil with some clay in it. Cobbles on surface as well as a glacial erratic.
Point 152—Canton and Charlton. This is a sandy loam, much less stony than Paxton-Montauk, with a steep gradient. We found its soil profile to be:

- O Horizon: indistinct
- A Horizon: 9 inches, nice soil, great loamy soil
- B Horizon: Below 9 inches, sandier, less silt, coarser, sandier soil
- Possibly an AP Horizon, indicating plowing.

Point 155—Hollis-Chatfield (described previously), very rocky, with boulders on top. We found its soil profile to be:

- A Horizon: 4-5 inches, loamy, fine textures and rocky
- B Horizon: Below the A, sandier with clay and lighter color
- Mesic, well drained but not dry

Point 157—Sutton. Not so stony on surface or belowground. This is a loamy soil, well drained, finely textured. We found its soil profile to be:

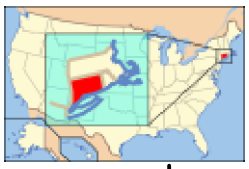
- O Horizon: Indistinct
- A Horizon: big, 12 inches
- B Horizon: Below 12 inches, there is a sandier B layer

Point 161—Paxton and Montauk (described previously). We found its soil profile to be:

- O Horizon: distinct, half inch
- A Horizon: at least 12 inches light brown, sandy loam, well drained, moderate structure, free of gravel
- No rocks on top, mesic, steep slope

APPENDIX E: PROPERTY SOILS MAPS AND WAYPOINT LOCATIONS

Pole Bridge



N
W
E
S

130 65 0 130 Meters

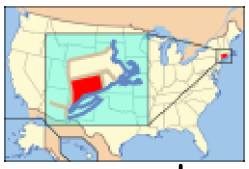
Map Creator: Lucien A. Bouffard

Pond Brook

0 155 310 620 Feet

Map Creator:Lucien Bouffard

Stone Bridge



649900.000000 650000.000000 650100.000000 650200.000000

4584200.000000 4584100.000000 4584000.000000 4583900.000000 4583800.000000 4583700.000000

126
128
125
34.29 Acres
124
123
117
118
119
122
121

649800.000000 649900.000000 650000.000000 650100.000000 650200.000000

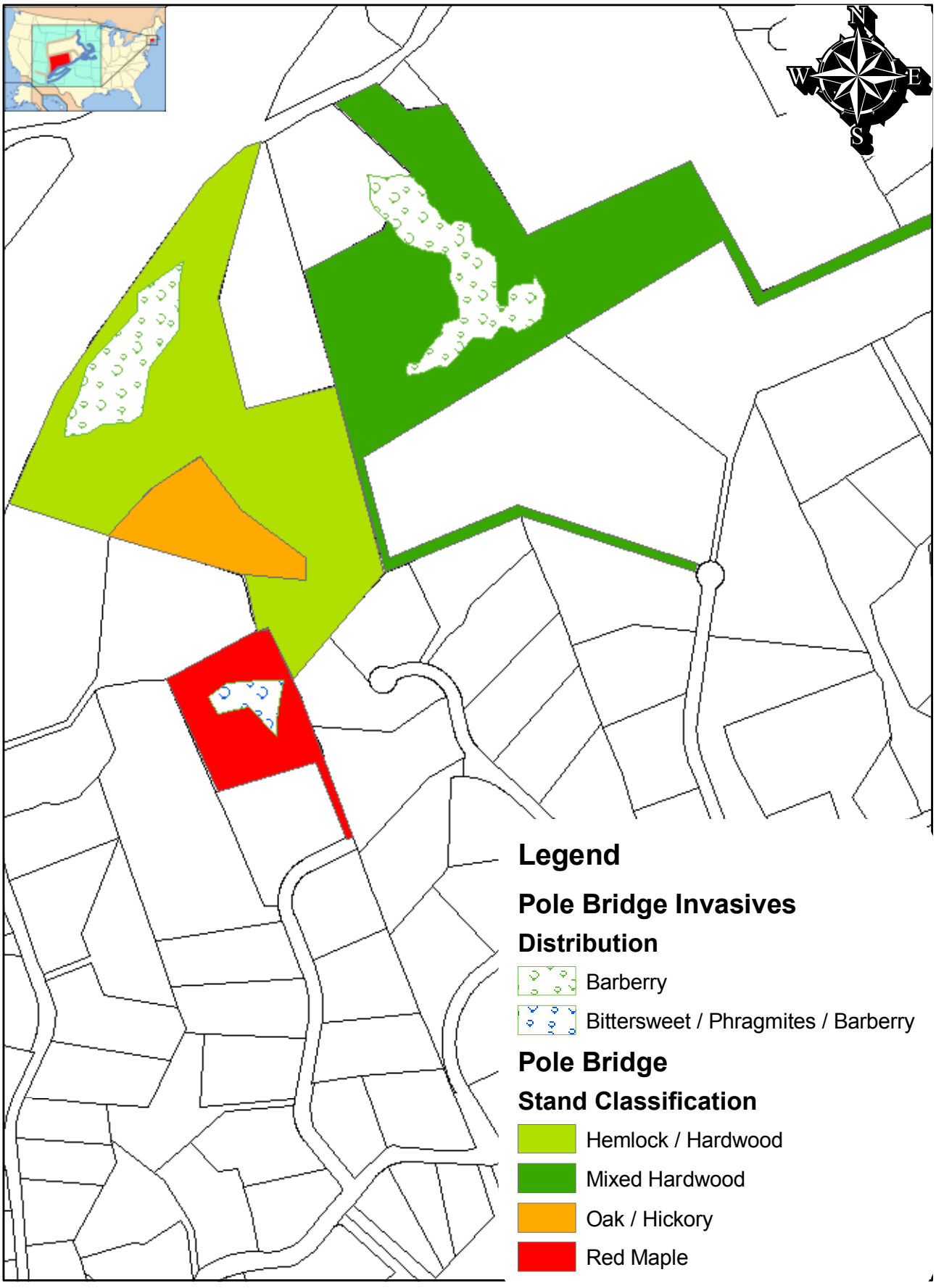
N
W E
S

70 35 0 70 Meters

Map Creator: Lucien A. Bouffard

APPENDIX F: INVASIVE PLANT MAPS BY PROPERTY

Pole Bridge Invasives



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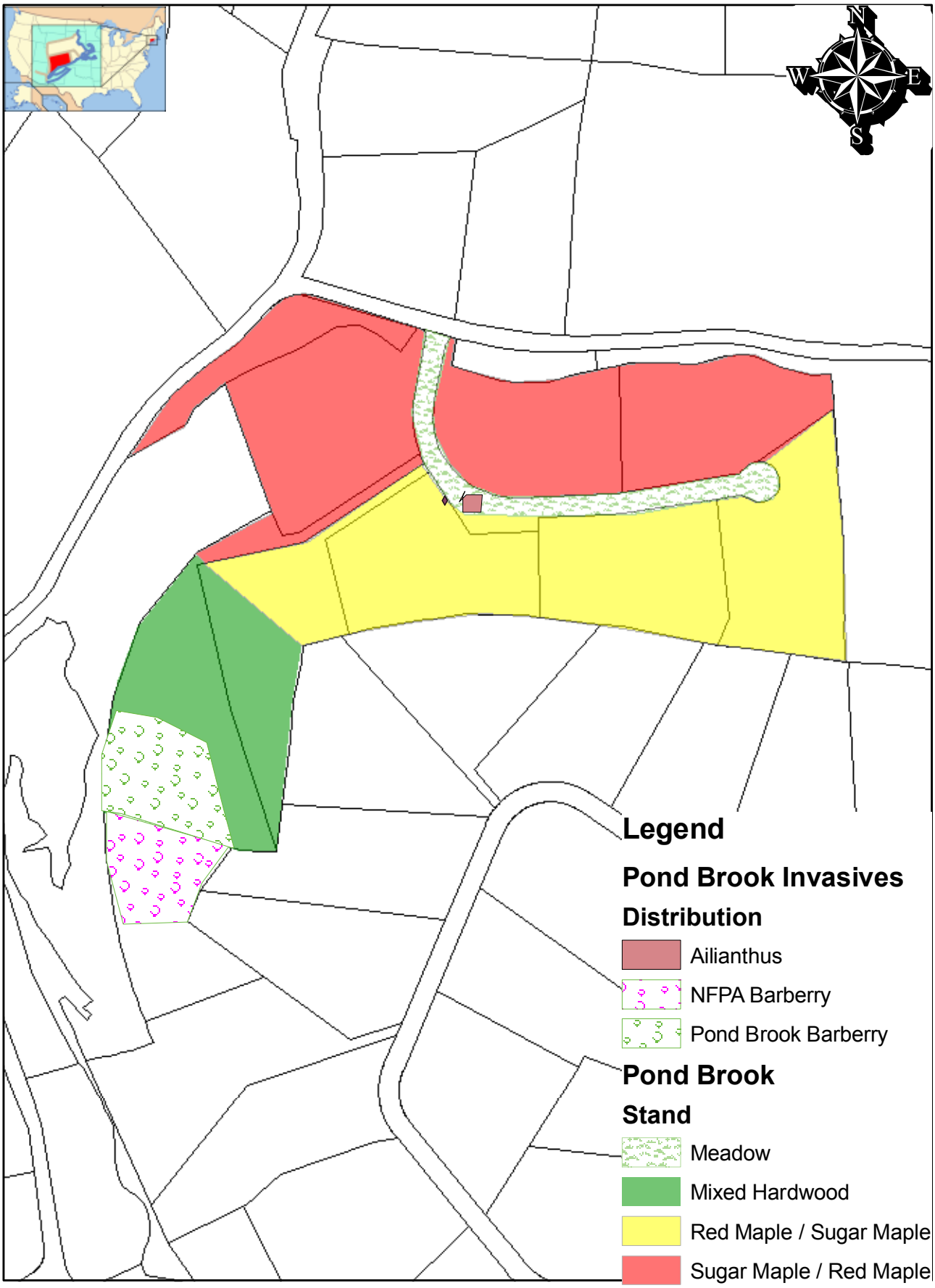
Map Creator: Lucien A. Bouffard

Pond Brook Invasives



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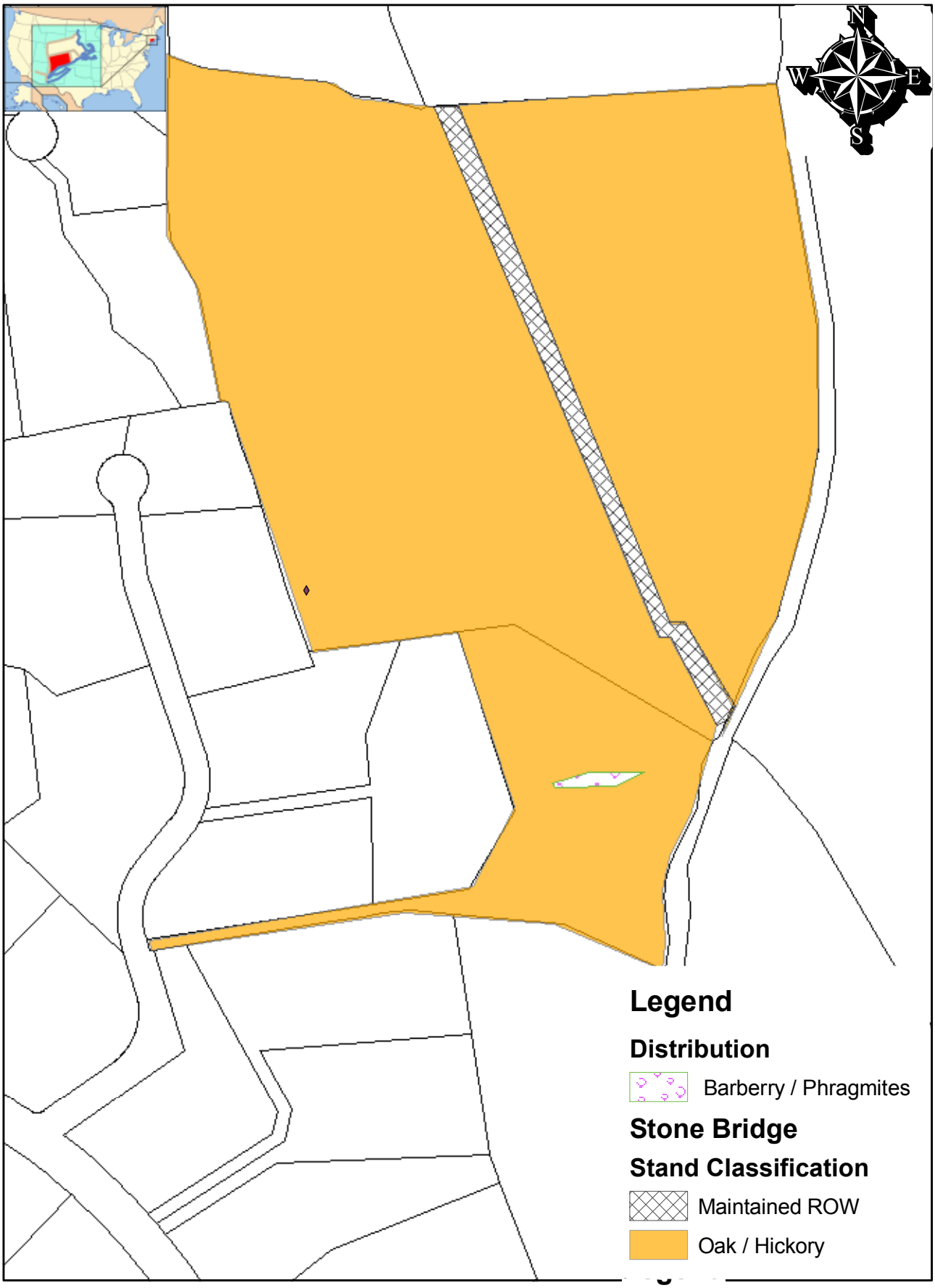
Map Creator: Lucien A. Bouffard

Stone Bridge Invasives



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Map Creator: Lucien A. Bouffard

APPENDIX G: OVERARCHING RECOMMENDATIONS

OVERARCHING ISSUES	OPTIONS	PROS	CONS	RATIONALE FOR RECOMMENDATION	RECOMMENDATION
Deer and Ticks					
Lyme Disease - landscape level	Planning, outreach, education			A complex issue impacting many stakeholders and stemming from a complex interaction of social and biological factors	Land use planning and conservation acquisitions to target intact, minimally fragmented parcels as a way to address Lyme disease; continued stakeholder engagement (through the committee and other arenas)
Lanscape-level issues	A number of practices can be done, from using sawdust to create barriers, to avoiding the use of ornamental plants	Non-intrusive for environment, benefits to safety of residents	Neighbors are diffuse and may have varying receptivity to changing appearances oftheir own properties	Lyme disease is a complex phenomemon that transcends political/open space boudnaries	Work with neighboring landowners to control invasives, create yards that are not palatable/accessible/inviting to deer
Lyme Disease - property level	Passive and Active Management			A complex issue impacting many stakeholders and stemming from a complex interaction of social and biological factors	Education; 4 Post Devices; Rodent targeting; Enhance opportunities for predators;

APPENDIX H: RECOMMENDATIONS BY PROPERTY

POLE BRIDGE RECOMMENDATIONS					
ISSUES	**OPTIONS**	**PROS**	**CONS**	**RATIONALE FOR RECOMMENDATION**	**RECOMMENDATION**
Forest Health					
Lack of regeneration and ground story diversity	1. Open up the canopy of some stands via heavy crown thinning or shelterwood regeneration cut 2. Create snags by girdling to open up small isolated gaps to increase light reaching forest floor	1. regeneration cut could increase bird diversity; vigorous ground story will develop; create greater vertical structure- could increase wildlife habitat value; to some people this forest may look nicer. 2. a small amount of the canopy will be opened but not enough to allow invasives to become prevalent; will increase snags for wildlife habitat	1. the only access to the property is through the steep sloped and sensitive hemlock stand- any disturbance could affect this stand negatively- cause high soil erosion and increase presence of pests such as elongate hemlock scale. 2. leaving standing dead trees could be seen as a safety hazard if done close to trails	limit invasive establishment and proliferation in forest interior; prevent large harvesting machinery use	Girdle selective trees in all stands except the hemlock-hardwood stand on the hillside, preferably maintaining at least five snags/acre, each having at least ten inch DBH.
Sensitive Hemlock stand with Elongate Hemlock Scale Presence; potential for wooly adelgid infestation; climate change induced drought effects on hemlock	1. preserve the stand by salvage harvesting the declining hemlocks 2. leave alone and monitor the stand for decline in stand health (reduced crown vigor; presence of scale and/or adelgid)	1. could reduce severity of outbreak and prolong the presence of the hemlock stand; remove safety hazard of dying trees falling onto trails. 2. allow the stand to respond on its own and prevent needless tree removal efforts and costs	1. harvesting will increase erosion and could negatively impact vigor of residual trees via abrasion during tree felling. 2. if the insects increase in population quickly it may be late to respond at a later date and a large component of the hemlocks will be lost	the stand is generally healthy and given the site's appropriateness for hemlock to grow well, the stand has a high chance of surviving future insect outbreaks and drought events	Leave alone and monitor the stand for decline in vigor (live crown) and appearance of wooly adelgid. if adelgid appears at any time, harvest and remove any infected trees as soon as possible.
Large Japanese barberry patches in Mixed Hardwood stand	use Parks and Rec for mechanical/chemical treatments; 1. mechanical treatment: mowing or cutting 2. mechanical treatment plus localized herbicide use	1. no herbicide use. would help to reduce the prevalence of this plant on the property, and prevent it from spreading. 2. more effective method than just mechanical treatment. More cost effective as will not need to be re-treated as often as option 1.	1. repeated mowing or cutting will control the spread of Japanese barberry but will not eradicate it.continued control will be necessary; mosre costly due to labor required since it would not be feasible to ask volunteer groups to pull barberry due to the thorns. 2. herbicide use is controversial because of potential negative ecosystem effects, particularly if overapplied.	choosing the most effective and cost-effective treatment	Cutting/brush mowing once per growing season in late summer and use a cut-stump herbicide once a year until the root systems stop producing shoots. Ask Iroquois Gas Transmission System, LP to control invasives on their easements, and ask Newtown Forest Association to work together to control the barberry patches on their property that are
Asiatic bittersweet strangling early successional trees on edge of red maple stand, further encroachment into stand	1. Cut climbing or trailing vines as close to the root collar as possible. Oriental bittersweet will re-sprout unless cut so frequently that its root stock is exhausted. Treatment should begin early in the growing season and be repeated at 2-week intervals until autumn.	prevent further tree mortality and encroachment in stand, no herbicide use	will require continued efforts to effectively control the vines, therefore higher cost than herbicide use	prevent spread effectively and cost effectiveness	see below
	2. Cut or girdle climbing and trailing vines just above ground level in early fall. Paint undiluted triclopyr into the freshly cut surfaces of the stump. Repeated applications may be necessary to eliminate re-sprouting.	prevent further tree mortality and encroachment in stand; lower cost than option 1	use of herbicide	prevent spread effectively and cost effectiveness	Option 2- cutting/girdling and herbicide use

POLE BRIDGE RECOMMENDATIONS (continued)

ISSUES	OPTIONS	PROS	CONS	RATIONALE FOR RECOMMENDATION	RECOMMENDATION
Wildlife					
Almost 80Db of noise coming from highway	1) noise barrier between forest and highway. 2) living fence	Reduce noise from highway	High Cost	By reducing the noise from the highway secondary benefits to predetory prey relationships includign rodent management and biodiversity will be levied.	
Baiting deer in the Iroquois right of way	Warden visits regularly	Enforcement of regulations	Upset hunter	By enforcing regulations standards are maintained for hunters in Newtown	
Environmental Education					
Kiosk not Maintained	Improve the Kiosk to include trail map and interpretation for the site.	Great for interpretation of the various forest types and habitats in the area	Possible site for graffitti	By educating children and adults at pond brook stewardship, voluteerism and Money can come back to the town by contributions of visitors.	Improve the kiosk with information on the trails of Pole Bridge.
Recreation and Trails					
Erosion on main access trail	Water bars should be added	Requires labor	Excellent Boy Scout project		
Little visibility of property and trail	Clear trees around existing sign				
Existing trail used by few people	1. Increase signage and publicity	Cheap and quick	Not really a loop trail		
	2. Add loop hiking trail (and signage and publicity)	Would improve quality of trail	Would miss opportunity for good mountain bike trail		
	3. Develop a mountain bike loop (and improve signage and publicity)	Property has enough slope to be good for mountain bikers, avid interest from mountain bike club leader	Some users might not like to hike with mountain bikers	Only one of three properties would have mountain bike trail developed	
Deer and Ticks					
Issues with the properties	A number of methods for raising awareness exist, from fosucing on spatial and temporal distribution of ticks, to the community ecology of vectors and hosts, to the personal protective measures one should take	Can remove or decrease vectors that transmit disease and improve forest health via removal of invasive species	4-poster is costly in terms of labor for baiting and monitoring; effectivenss of many methods is suspect; health concerns with use of chemicals	There are many vectors of Lyme disease, invovled in complex dyamics over space and time. Deer sprayed with mild insecticide can act as vaccuum, sucking up and killing more ticks than a moderate deer cull might	Target vectors (4 posts, rodent bait boxes); control of barbery as previoulsy outlined and control of noise (to improve habitat for noise-sensitive predators that feed of rodents

POLE BRIDGE steps to implement recommendations

RECOMMENDATION	Near-term (next year)	Mid-term (2-4 yrs)	Long-term (5-10 yrs)
Forest Health			
Girdle selective trees in all stands except the hemlock-hardwood stand on the hillside, favoring red maples where possible because of their high wildlife habitat quality.	girdle according to wildlife habitat needs in stands; ask Iroquois Gas Transmission System, L.P. to control the invasives on their easement to help prevent invasive establishment where the canopy is opened up.	Leave alone and monitor for invasives in small gaps created; continue to ask Iroquois to control invasives on their properties	Monitor girdled trees for safety hazard trees and cut any hazardous trees
Leave alone and monitor the stand for decline in vigor (live crown) and appearance of wooly adelgid. if adelgid appears at any time, harvest and remove any infected trees as soon as possible.	Leave alone and monitor. Any wooly adelgid infected trees should be removed as soon as possible.	Continue to monitor and if hemlocks begin to decline severly due to hemlock scale then consider salvage harvesting senescing individuals that pose a safety hazard. Any wooly adelgid infected trees should be removed as soon as possible.	Continue to monitor and if hemlocks begin to decline severly due to hemlock scale then consider salvage harvesting senescing individuals that pose a safety hazard. Any wooly adelgid infected trees should be removed as soon as possible.
Cutting/brush mowing once per growing season in late summer and use a cut-stump herbicide once a year until the root systems stop producing shoots. Ask Iroquois Gas Transmission System, LP to control invasives on their easements, and ask Newtown Forest Association to work together to control the barberry patches on their property that are encroaching town land.	Cut with brush hog and apply a cut-stump herbicide. Ask Iroquois Gas Transmission System, LP to control invasives on their easements, and ask Newtown Forest Association to work together to control the barberry patches on their property that are encroaching town land	Same as near term, continue to look for patches expanding and control them. Continue to monitor neighboring properties and gas pipeline easement for increases in invasive populations and continue to ask for property owner's help with control	Continued monitoring and control as necessary
Option 2- cutting/girdling and herbicide use	Cut or girdle climbing and trailing vines just above ground level in early fall. Paint undiluted triclopyr into the freshly cut surfaces of the stump.	monitor and repeat treatment when needed	monitor and repeat treatment if necessary

POLE BRIDGE steps to implement recommendations (continued)			
RECOMMENDATION	**Near-term (next year)**	**Mid-term (2-4 yrs)**	**Long-term (5-10 yrs)**
Wildlife			
	Monitor hunting at baiting locations	Monitor hunting at baiting locations	Monitor hunting at baiting locations
Environmental Education			
Improve the kiosk with information on the trails of Pole Bridge.	Encourage Volunteerism and stewardship at preserves	Improve trail conditions	Develop sustainable environmental eudcation programming for all town lands
Recreation and Trails			
Develop mountain bike and hiking trail	Recruit stakeholders to develop trail plan	Plan and build trail that includes these features: use the main access trail up from Pole Bridge Road, past the kiosk, through the oak-hickory stand to the Iroquois gas pipeline, loops back through the hemlock stand, goes through the ash pole stand, follows the stone wall by the large oak and maple wolf trees at the top of the hill of the hardwood stand, and avoids the stream in the mixed hardwood stand on the northeastern side of the property	
Deer and Ticks			
Target vectors (4 posts, rodent bait boxes); control of barbery as previoulsy outlined and control of noise (to improve habitat for noise-sensitive predators that feed on rodents	Clarify what conditions there are for using 4-posts; work with Tick-Borne Disease Committee and Parks and Rec to develop this adaptive program; monitor for predators	Site locations for 4-poster devices; monitor predators and abitiotic factors like noise level	Implement, monitor, adapt practice

POND BROOK RECOMMENDATIONS

ISSUES	OPTIONS	PROS	CONS	RATIONALE FOR RECOMMENDATION	RECOMMENDATION
Forest Health					
Lack of regeneration and ground-story diversity	1. Open up the canopy of some stands via heavy crown thinning or shelterwood regeneration cut 2. Create snags by girdling to open up small isolated gaps to increase light reaching forest floor	1. regeneration cut could increase bird diversity; vigorous ground story will develop; create greater vertical structure- could increase wildlife habitat value; to some people this forest may look nicer. 2. a small amount of the canopy will be opened but not enough to allow invasives to become prevalent; will increase snags for wildlife habitat	1. The clearing unintentionally created great groundstory diversity, and any further harvesting would require an army corps engineer permit and have negative impacts on the brook water quality 2. leaving standing dead trees could be seen as a safety hazard if done close to trails	No road access and potential negative effects on the forest if canopy is opened up too much at once	Girdle selective trees in all stands except the hemlock-hardwood stand on the hillside, preferably maintaining at least five snags/acre, each having at least ten inch DBH.
Tree of Heaven establishment in open meadow	1. Cut the individuals twice a year until the root system finally dies 2. Cut the stem and apply herbicide to prevent re-sprouting	1. no use of herbicide 2. Herbicide is cheaper than continued labour	1. more costly, unless volunteer group is organized. 2. Herbicide use conflicts with people's values	most timely and cost effective option	Cut and apply herbicide to cut stem
Wildlife					
Sand from roads degrades fish habitat	Pick up sand leftover after winter road treatment	1) Increased fish populations and genetic diversity, 2) increased revenue from fishing sales licences and equipment	Extra cost to town	By increasing fish populations more revenue will be generated from fishing gear sales and licences in Newtown.	Improve stream conditions to facilitate native fish in the stream
Maintain meadow habitat as valuable for neotropical birds and boreal birds overwintering	1. Burn	1) Increased bird populations 2) Fire will manage for warm season grasses	1) fire risk 2) permits and applicable paperwork is extensive and 3) thelong, narrow meadow isn't shaped well for burning.	Fire will remove invasive species that are not adapted to fire.	While burning may be more effective against invasive forbs, and would encourage the growth of warm-season grasses, which can withstand fire and are an important component of meadows and prairies, the long, narrow shape of the meadow is ill-suited to burning.
	2. Mow	Increased bird populations	1) Cost and annual maintainance. 2) increased risk of invasive species	Mowing will manage for herbacouse and woody vegetation. However, mowing will not eliminate invasive spcies or foster warm season grasses.	Implement mowing strategy to manage meadow for woody species, preferably before April 15th.
Environmental Education					
Significant historical and ecological resources aren't accessible (see below) or interpreted for visitors	1) Include cultural and environmental education at site using signage. 2) use cellular phones as a method for interpretation on a guided trail.	Increase awarness of environment and Cultural history	Possible site for graffitti	This sites rich history allows for an in depth education into settlement of connecticut and its early agricultural and forestry practices.	1) put in signage at old dam 2) put in signage at meadow 3) Possibly use cell phones as a method for interpreation on trail

POND BROOK RECOMMENDATIONS, continued

ISSUES	OPTIONS	PROS	CONS	RATIONALE FOR RECOMMENDATION	RECOMMENDATION
Recreation and Trails					
Pond Brook is currently unaccessible	1. Build a footbridge across Pond Brook (and have parking along Pond Brook Road)	Less clearing required on property for parking lot, bridge could be clearly connected to trails	Very limited parking space along Pond Brook Road, increased potential for accidents on road and possible liability	Would provide relatively inexpensive access without overwhelming the property with visitors	1. Build a footbridge across Pond Brook (and have parking along Pond Brook Road)
	2. Investigate whether neighboring properties have existing trail easements; if not, try to secure trail easements	More land preserved, longer trail available, cheaper and quicker than car bridge; cheaper than buying property	Might not be possible to buy properties	Would provide greater access without the cost and possible ecological impacts of a bridge	2. Investigate whether neighboring properties have existing trail easements; if not, try to secure trail easements
	3. Purchase nearby property that has access to railroad grade and secure access to railroad grade between properties				
	4. Build car bridge across Pond Brook and have parking on property	More space for cars	Cost, time, risk of excessive use of property and risk of ecological impacts on Pond Brook		
Few longer, interconnected trails in Newtown	1. Let other communities build trails first to see where trail routes are developing	Less investment and risk	Trail routes might not connect Newtown		
	2. Actively pursue development of rail trail		Staff time and money	With its five rail lines, Newtown has opportunity to develop rail-trails into valuable community amenity	
Old tennis court and fence. The court still has an approximately ten foot-high chain link fence around it	Removing the tennis court and fence. The tennis court isn't in keeping with the nature of the playscape we recommend or the historical era of the interpretive elements	Would bring site into conformance with more natural aesthetic and historical era	Cost and lack of access to remove asphalt and fencing		
	Leaving court and only cutting down and rolling up fence and posts	Would reduce bigger danger of the fence	Wouldn't bring site into aesthetic and historical conformance as quickly	the tennis court itself is neither obtrusive nor dangerous, and the fence could be quickly cut down and rolled and left on-site until a bridge or other access is secured	
Deer and Ticks					
Issues with the properties	A number of methods exist for targeting Lyme disease (from removing leaf litter prescribed burns for reducing tick habitat, to targeting other hosts and vectors, to personal protection)	Can remove or decrease vectors that transmit disease and improve forest health via removal of invasive species	4-poster is costly in terms of labor for baiting and monitoring; effectiveness of many methods is suspect; health concerns with use of chemicals	There are many vectors of Lyme disease, invovled in complex dyamics over space and time. Deer sprayed with mild insecticide can act as vaccuum, sucking up and killing more ticks than a moderate deer cull might	Target deer with 4 poster device that is placed in an easily accssible location to bate and monitor
Meadow edge habitat	As prescribed above, burning will target invasives and foster wildlife habitat	As an ancillary benefit, it can reduce invasive species and remove ticks and tick habitat	Labor costs; fire-safety issues; not the prime habitat of ticks	Mutiple benefits for prescribed burn (ticks, forest health, migrating birds)	Prescribed burn every 3 years, with monitoring and adaptative management

POND BROOK steps to implement recommendations

RECOMMENDATION	Near-term (next year)	Mid-term (2-4 yrs)	Long-term (5-10 yrs)
Forest Health			
Girdle selective trees, favoring red maples where possible because of their high wildlife habitat quality.	girdle according to wildlife habitat needs in stands; ask Newtown Forest Assocation to control large barberry patches on their property	Leave alone and monitor for invasives in small gaps created; continue to ask Iroquois to control invasives on their properties	monitor girdled trees for safety hazard trees and cut any hazardous trees.
Cut and apply herbicide to cut stem	Cut and spray individuals currently present on the sites	Possibly cut and spray sprouts. Check if new individuals have established and treat them	Monitor stand edges and clearing for new tree of heaven establishment
Wildlife			
Improve stream conditions to facilitate native fish in the stream	1) Find a stream steward and a monitor sand in the stream 2) Recover sand from road edges immediately after the winter. 3) target roads near streams in	Implement sand pickup	Increase fish stocks
Mowing meadow to maintain it as habitat for ground-nesting birds	Begin mowing every other year, preferably in late winter	Continue to mow and monitor for invasives.	Continue to mow and monitor for invasives.
Environmental Education			
1) put in signage at old dam 2) put in signage at meadow 3) Possibly use cell phones as a method for interpreation on trail	1) Encourage Volunteerism and stewardship at preserves. 2) devlope an all around progam for cultural and natural history education at pond brook	Install interpretive signage at the following features: old dam and mill site, blasting holes on rock outcrop to interpret railroad history, any archeological discoveries, the hemlock-hardwood stand, the importance of the meadow to ground-nesting birds, and one describing how this property from development; and raise awareness about Lyme disease and community ecology of vectors and hosts	Develop sustainable environmental education programming for all town lands

POND BROOK steps to implement recommendations (continued)

RECOMMENDATION	Near-term (next year)	Mid-term (2-4 yrs)	Long-term (5-10 yrs)
Recreation and Trails			
	Start process of designing a natural playscape	fit project into town's infrastructure budget and planning	build park and bridge
	Inquire to see if existing trail easements exist; if not, check to see if owners are willing to sell, or grant access through trail easements; work with Newtown Forest Association		
	Reach out to Rails to Trails Conservancy to get their advice on first steps, check with nearby towns with rail-trails to see if they plan to extend their trails		
Deer and Ticks			
Target deer with 4 poster device that is placed in an easily accssible location to bate and monitor	Clarify what conditions there are for using 4-posts; work with Tick-Borne Disease Committee and Parks and Rec to develop this adaptive program	Site locations for 4-poster devices	Implement, monitor, adapt practice

STONE BRIDGE RECOMMENDATIONS

ISSUES	OPTIONS	PROS	CONS	RATIONALE FOR RECOMMENDATION	RECOMMENDATION
Forest Health					
Lack of regeneration and ground story diversity	1. Open up the canopy of some stands via heavy crown thinning or shelterwood regeneration cut 2. Create snags by girdling to open up small isolated gaps to increase light reaching forest floor	1. regeneration cut could increase bird diversity; vigorous ground story will develop; create greater vertical structure- could increase wildlife habitat value; to some people this forest may look nicer. 2. a small amount of the canopy will be opened but not enough to allow invasives to become prevalent; will increase snags for wildlife habitat	1. Opening up the canopy substantially would create greater early successional and edge habitat and risk more invasives; edges are already prevalent with the trails, the gas pipeline, and in Paugussett State Forest 2. leaving standing dead trees could be seen as a safety hazard if done close to trails	limit invasive establishment and proliferation in forest interior and prevent large increase in edge habitat	Girdle selective, larger-diameter trees for their high wildlife habitat value, preferably maintaining at least five snags/acre, each having at least ten inch DBH.
Iroquois Gas Transmission Systems, LP easement is a corridor for invasive plant spread	The only option is to ask Iroquois to mow more frequently	reduce invasive spread	Iroquois Gas Pipeline LP has committed to mowing their grassy ROWs no more frequently than every 3 years. Otherwise there is no accountability for invasives control.	The only option	Ask Iroquois to mow more frequently
Wildlife					
Lack of cavities and standing dead wood for insect eating birds and other wildlife.	Increase standing dead wood by girdling. 2) increase standing dead wood by injection	Increase forest heterogeneity and wildlife diversity	Possible health and safety problems with falling limbs and trees	Increaseing forest biodiverisity will provide community with more wildlife viewing opportunities	Increase standing dead wood by girdling or injection.
Lack of nesting sites in the forest.	1) put in nest boxes 2) Put in butterfly boxes 3) put in bat boxes	Increase wildlife habitat for breeding and early life developemnt phases.	Maintainance of boxes necessitates a steward	Lack of cavities and other habitat in the homogeneouse stand.	Improve wildlife habitat by putting in boxes for wildlife breeding and hibernation/aestivation
Environmental Education					
No development or installations are recommended, but the property is well-suited for environmental education by school groups	1) Develop curriculum for Stone Bridge as a site for environmental education. 2) groups include K-6 graders along with scouts and other community groups. 3) environmental education program can have a positive effect on the community	1) Lots of open forest to allow students to move around unobstructed. 2) An environmental education program at Stone Bridge can train tomorrows land stewards.	1) Cost for development of curriculum at site. 2) Development of curriculum can be costly and difficult to coordinate.	As the site is undeveloped, it is an opportunity to design an environmental education program in combination with trails and other infrastructure.	Develop environmental education curriculum that will coincide with valuable teaching points at Stone Bridge

STONE BRIDGE RECOMMENDATIONS (continued)

ISSUES	OPTIONS	PROS	CONS	RATIONALE FOR RECOMMENDATION	RECOMMENDATION
Recreation and Trails					
Lack of access to the Lower Block of Paugussett State Forest	1. Continue to let a few locals use Stone Bridge road and parking as access	No cost, little risk	Few users		
	2. Develop Stone Bridge as access to Lower Block of Paugussett	Would give access to Blue-blazed Zoar Trail	Would increase traffic, possibly illegal hunting, traffic and risk		
Deer and Ticks					
Issues with the properties	A number of methods exist for targeting Lyme disease (from removing leaf litter prescribed burns for reducing tick habitat, to targeting other hosts and vectors, to personal protection)	management can remove or decrease vectors that transmit disease and reduce forest health	Costly in terms of labor for baiting and monitoring! many methods are new (e.g. bait boxes) and potentially ineffective	There are many vectors of Lyme disease, invovled in complex dyamics over space and time. Deer sprayed with mild insecticide can act as vaccuum, sucking up and killing more ticks than a moderate deer cull might	Target deer with 4 poster device that is placed in an easily accssible location to bate and monitor; increasing standing dead wood, as outlined above, will increase the light regime and decrease humidity of the understory (which ticks require)
Raise Awareness	A number of methods for raising awareness exist, from fosucing on spatial and temporal distribution of ticks, to the community ecology of vectors and hosts, to the personal protective measures one should take	One of the easiest, least costly, and most tractable short-term solutions	Signs may be removed or disregarded; some stakeholders may feel more steps need to be taken	Intervening in the complex ecological and social systems to abate Lyme disease can be controversial and ineffective; raising awareness is a feasible alternative	Place signs at the parking lots and near the trail head

STONE BRIDGE steps to implement recommendations

RECOMMENDATION	Near-term (next year)	Mid-term (2-4 yrs)	Long-term (5-10 yrs)
Forest Health			
Girdle selective trees, favoring red maples where possible because of their high wildlife habitat quality.	girdle according to wildlife habitat needs in stands; ask Iroquois Gas Transmission System, L.P. to control the invasives on their easement to help prevent invasive establishment where the canopy is opened up.	Leave alone and monitor for invasives in small gaps created; continue to ask Iroquois to control invasives on their properties	monitor girdled trees for safety hazard trees and cut any hazardous trees. Once invasives are minimized then re-consider costs and benefits of doing a shelterwood treatment
Wildlife			
Increase standing dead wood by girdling or injection.	Determine girdling rate, girdle some trees	Maintain snags in forest	Maintain snags in forest and monitor wildlife populations dependent on snags
Improve wildlife habitat by putting in boxes for wildlife breeding and hibernation/aestivation	1) Recuit steward for property to maintain boxes. 2) put in boxes	Maintain boxes and develop education program around the boxes	ongoing maintainance and teaching.
Environmental Education			
Develop environmental education curriculum that will coincide with valuable teaching points at Stone Bridge	Improve parking in order to better facilitate school groups attending for environmental education through schools.	Consider changing landscape while developing environmental programming.	Reach out to public schools and community with developed program

STONE BRIDGE steps to implement recommendations (continued)			
RECOMMENDATION	**Near-term (next year)**	**Mid-term (2-4 yrs)**	**Long-term (5-10 yrs)**
Recreation and Trails			
Improve access to Lower Block of Paugussett State Forest	Begin conversation with State Forest officials and Connecticut Forest and Parks Association	Add sign along road, improve parking lot	
Deer and Ticks			
Target deer with 4 poster device that is placed in an easily accssible location to bate and monitor; increasing standing dead wood, as outlined above, will increase the light regime and decrease humidity of the understory (which ticks require)	Clarify what conditions there are for using 4-posts; work with Tick-Borne Disease Committee and Parks and Rec to develop this adaptive program	Site locations for 4-poster devices	Implement, monitor, adapt practice

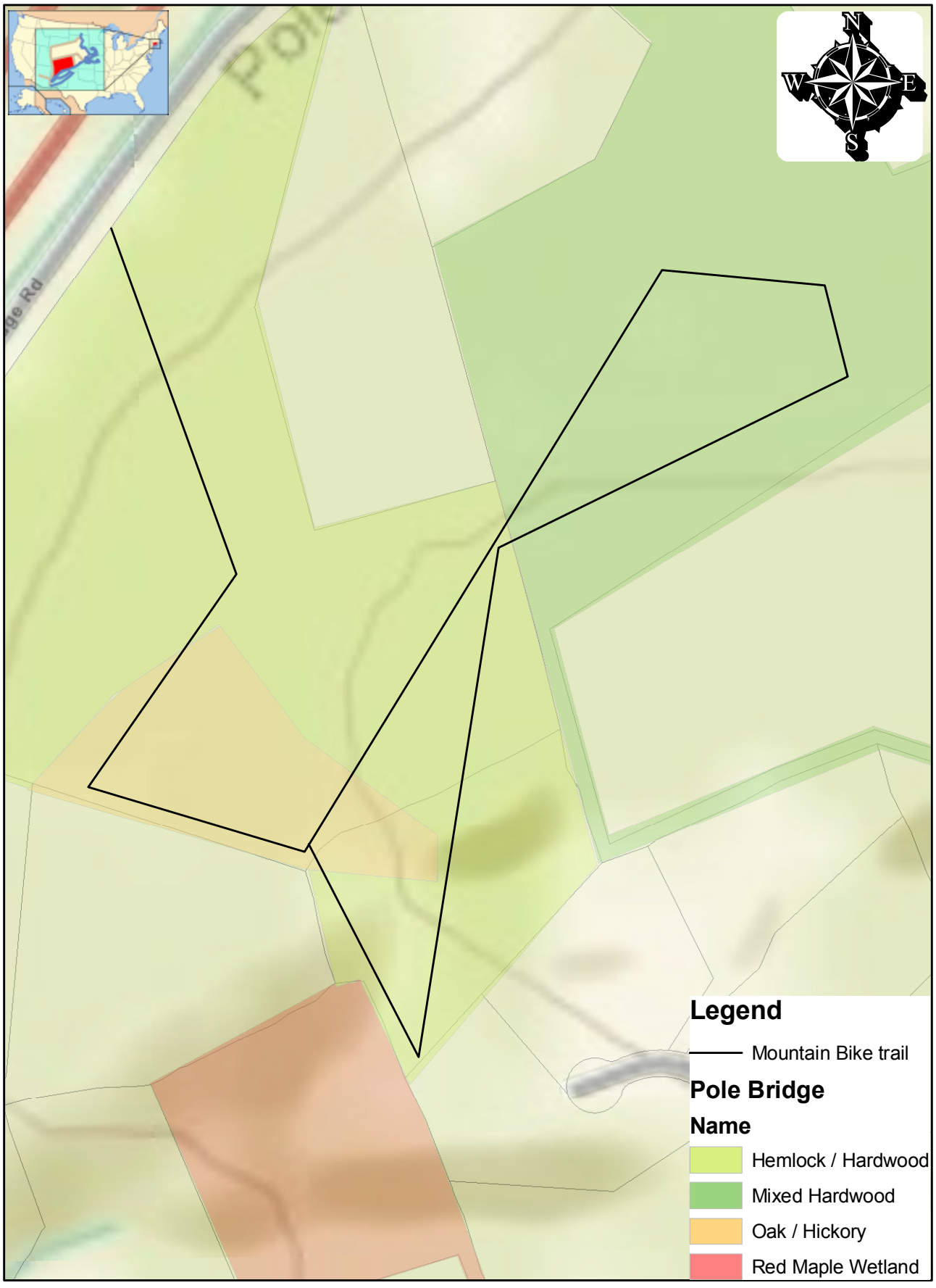
APPENDIX I: SUMMARY TABLE OF STAKEHOLDER ANALYSIS

Participant	*Perspective*	*Decision Process*	*Conflict*
Conservation Commission	Appointed citizens with keen interest in open space and other environmental values	A committee of the Planning and Land Use Commission with budget to select and acquire properties	Open space signs are sometimes removed, some properties are underutilized or used for prohibited purposes, and the Commission faces competing demands and interests for managing their properties
Newtown Forest Association	Private land trust dedicated to accumulating and preserving open space and resources for public enjoyment	They operate independently from formal, town decision processes	Some of their properties have high abundance of invasive species, posing current and potential problems for neighboring properties
Hunters	Individuals with varying interest in using the open space properties	The Ad Hoc Tick-Borne Disease Action Committee may impact deer hunters with some of their management recommendations	Some stakeholders are concerned with the actual and perceived safety risks and express ethical oppositions
Neighbors	Varying roles and interests, with concerns about public use and further development	They have varying willingness and abilities to engage in and influence decisions	Some have witnessed a variety of encroachments and are opposed to increased public use and access
Fishers	Seek places to fish and have concerns about decreased water levels from other human uses	Several hold positions in the town government	Unclear
Town Historian	Interest in the history and early culture of Newtown, preservation, and education	Helped develop town's archaeological regulations and highly respected by many community members	Interest in historical preservation could potentially conflict with other interests like recreation
Walker/Hiker	Seek opportunities to walk and hike and are concerned with other forms of use that might detract from their experience	Several hold positions in the town government	Concerns about other forms of use, especially mountain biking, ATV use, and hunting
Land Use Agency	Seeks to balance conservation with economic development and other community values	Has staff that work with and oversee several commissions	Face stakeholders with varying views on how open space is supposed to be used

Trails Sub-Committee	Seeks to create multi-purpose trails and strategic planning	Part of the Parks and Recreation Commission	Tacit concern from those valuing preservation that the sub-committee sides with mountain bikes and bike trails – which are viewed as intrusive and potentially harmful to habitat.
Mountain Bikers	Seek trails that are compatible for bike riding, which they view as a healthy pursuit	Unclear	Some cyclists are concerned about safety of trails for bikes Some stakeholders are wary of mountain bike use and the impacts they have on the land and other users
Horse Back Riders	Seek opportunities to ride and to foster an interest in horseback riding	Through a non-profit organization, they work with landowners, developers, and the Land Use Agency	Some are concerned with hunting on adjacent lands and loss and degradation of trails from development
Cross Country Ski Club	Use several of the open space properties when the conditions permit	Unclear	Unclear

APPENDIX J: PROPOSED BIKE TRAIL AT POLE BRIDGE

Pole Bridge Mountain Bike Trail



0 125 250 500 Feet

Map Creator:Lucien Bouffard